DEC 16 1881

THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXIV.—No. 8. Whole No. 524. | NEW YORK, SATURDAY, APRIL 16, 1881. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3 50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers Street, New York, are agents for this Journal. Newsdealers will send orders to them.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this Journal a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of these subjects a pleasure or a profession.

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

Western Gas Association..... 169
Death of M. Pelouze..... 169

EDITORIALS—

The Public Lighting in the City of New York..... 169
Gas and Electricity..... 170
The Liegel Furnace..... 170
Suffocation by Gas..... 170
Edison Tries His Lamps..... 170
Eleventh Annual Meeting of the New England Association of Gas Engineers..... 171
Another Rival of Gas..... 175
The Transport of Materials for Gas Works..... 175
Gas Engines..... 177
Southern District Association of Gas Engineers and Managers..... 178
The Montreal Gas Company's Annual Meeting..... 179
An English Opinion on the Dieterich Furnace..... 179
Gas Lighted Buoys..... 180
The Electric Light in Mines..... 180
Consolidation..... 180
Steam Heating at Troy, N. Y..... 181
Telephones in India..... 181

[OFFICIAL NOTICE.]

Western Gas Association.

OFFICE OF SECRETARY WESTERN GAS ASSOCIATION,
ST. LOUIS, MO., March 25, 1881.

The Fourth Annual Meeting of the Western Gas Association will be held in St. Louis, Mo., on Wednesday, May 11th, 1881, at 10 A.M., and continue three days. Due notice of the place of meeting will be given.

LEE A. HALL,
Secretary.

DEATH OF M. PELOUZE.—M. Eugene Pelouze, Administrator of the Compagnie Parisienne du Gaz, and Member of the Chemical Institute, died recently at Cannes. His death was caused by an affection of the throat.

THE PUBLIC LIGHTING IN THE CITY OF NEW YORK.

The proposals for lighting the streets, avenues, parks, and public places of this city for one year, from the first of May next, have been opened by the authorities, and it is found that the prices for gas have been somewhat increased. The price for the majority of the lamps is eighteen dollars per year, for a consumption of 4,000 hours; this price includes the gas, lighting, cleaning and extinguishing. A very low price indeed, considering the quality of the gas and the service rendered.

Not as many proposals as expected were received from the electric light companies, of which there are some seven or eight organized in the city. But two bids were received, both from the Brush Electric Illuminating Company. They propose to furnish voltaic arc lights of 2000 candle power each, throughout Wall street; Broadway, from the Battery to Forty-second street; Fifth avenue, from Fourteenth street to Forty-fifth street; Eighth avenue, from Fourteenth street to Forty-fifth street; Fourteenth street, from Third avenue to Eighth avenue; Thirty fourth street, from Third avenue to Broadway; and two elevated groups of six lights, of 6000 candle power, on Madison and Union Squares—all for the sum of $32,000 a year.

The acceptance of the Brush Company's proposal would result in the displacement of about 1,700 gas lamps by about 340 electric lights, or one electric light would displace five gas lights, and the comparative cost would be gas, $30,600—electricity, $32,000.

We must confess that this is an extraordinarily low bid for electric lighting, considering the known expensiveness of the light, and what has been done in lighting Paris, London, Liverpool and other large cities.

In the city of London, on November 16, 1880, the Streets Committee reported to the City Commissioners of Sewers the tenders for lighting some of the streets by electricity. There were tenders for 235 electric lights altogether, including bids by such experienced electricians as the Siemens Brothers, and M. Jablochkoff, and the total cost for one year was $82,995 or an average cost for running each light 4,000 hours, the same time as in New York, $353. Besides there was the cost of placing and removing, amounting to $47,225, or $200 per lamp, thus making the total cost per lamp, per year, including removal, $553 per year.

Among the tenders was one from parties repsesenting the Brush system, for 32 lights (£1410) $7050, or at the rate of $220 per lamp per year, and this in London, where all the items entering into the cost of the light, such as fuel, labor, repairs, cost of plant, etc., are less than here. Substituting the London figures, for the Brush system, in New York, and the cost becomes $340 \times 220 = \$74,800$.

If we felt at all inimical to this system of lighting, or its progress, it would give us pleasure if the authorities should accept this proposal, as a few contracts like this would teach the stockholders of electric light companies the difference between making a light, selling it, and obtaining a fair return on their investment.

In a pamphlet, recently issued, on the "Electric Light for Industrial Uses," by L. E. Crompton, electric engineer, is given the cost of the carbons for the arc light, said cost having been determined practically in several places, including the Stanton Iron Works, Alexandra Palace, Barden Reservoir Works, British Museum and Blackpool. The maximum cost was 11 cents per hour, the minimum four, and the average, 6.4 cents.

Now, taking the lowest estimate for cost of carbons alone at four cents per hour and, applying it to the New York proposal, we have $4000 \times 4 = \$160$ as

the annual cost for carbon for each lamp, or the cost of the carbons alone, for 340 electric lights per annum, is $52,400. If we add to the expense for carbons the cost of fuel, labor, oil, water, repairs, taxes, superintendence, office expenses, and interest on capital, it becomes apparent why we consider the proposals extraordinary.

Not only this; but it seems about time electricians were more modest in talking about candle power. The talk of arc lights of one, two, six, or ten thousand candle power is generally sheer nonsense, and does not stand investigation.

We remember the amusement with which we regarded the statements of M. Jablochkoff that his lights in Paris were of 1,500 candle power. We had the temerity publicly to estimate them at 160 candle power at the outside. They were carefully determined afterwards by the municipal engineers of Paris to be of but 116 candle power at the pavement angle. The Jablochkoff lights, on the Thames Embankment, were subsequently determined, by Sir Joseph W. Bazalgette and Mr. T. W. Keates, to be of 155 candle power.

So it is with the systems proposed for New York—we believe the illuminating value of the electric lights on Broadway from 14th to 34th streets, to be not over one-fifth or one-sixth what is claimed. A city can and does measure the illuminating value of its gas to the fraction of a candle. How is it to determine the value of its electric lights? By guess? Or shall it accept as correct the thousand candle statements of electricians, some of whose lights have never been measured?

The only true system is that of Mr. Preece, President of the Society of Telegraphic Engineers, who, after protesting against the misuse of the term candle power, suggested that lights should be rated as capable of illuminating certain areas to a certain standard, thus virtually confirming the judgment of Mr. Sugg.

We have no doubt this basis will, finally, be reached; when it is we are sure gas will more than hold its own as a convenient, pleasant, safe and economical illuminant.

Gas and Electricity.

The bids for lighting the streets of the city during the year from May 1st were opened on Wednesday, March 30th. Those of the gas companies were considerably higher than last year, and for the first time an electric light company entered the lists against them as a bidder on a large scale. The company which holds the Brush patents offered to furnish for $32,000 the light now given by 1,700 ordinary gas lamps in one district, and for $7,400 that of 500 gas lamps in another and more limited district. The gas companies charged $18 a lamp in the thickly settled parts of the city, and higher rates in the northernmost wards.

There is accordingly little difference between the bids of the electric and gas companies, except in the case of the smaller district named by the Brush company. It had evidently obtained an inkling of what the bids of the gas people would be, and had regulated its own by them. And for the purpose of trial it put in its smaller bid.

If the Brush company gets the opportunity of lighting the streets on a more or less extensive scale, and does the work satisfactorily, the system will be so far successful. But the company will still be unsuccessful finan cially if it cannot also furnish light which shall be better than gaslight and cheaper. It must also be just as convenient for the consumer.

Unless it can produce the electric light at a very cheap rate, it can make no money out of the city at the prices named in its bids. The contract for lighting the streets is not one which is now a source of profit to the gas companies. If they had no other demand for their gas than that of the city, even at the higher rates they ask for the year to come, they would speedily be compelled to go out of business. There is no money in it. Even if the electric light should altogether displace gas in the public lamps, the gas companies would not suffer any pecuniary loss so long as they could supply private consumers. They even contend that they would make just as much money as before. As a matter of profit they do not seek the lighting of the streets they say.

Even if the Brush company gets the city lighting, therefore, it will only obtain the poorest part of the business. What the cost of production will be no one knows. We doubt whether the company itself can tell. It is obvious, however, that the work it proposes to do for $32,000 cannot be done at that cost. For this sum it offers to light for a year the whole of Wall street, Broadway from the Battery to Forty-second street, and side streets and avenues. That would be less than $90 a day. Of course, the electricity for that work cannot be generated for so paltry a sum, to say nothing of maintaining and keeping the lamps in order. The gas companies, which must of necessity supply private consumers, from whom they exact much higher prices, all along the routes, can afford to light the streets at so small cost comparatively.

The electric companies must be able to do the same thing; to supply shops and dwellings as well as the streets with their light. And they must let the people have a light which shall be better than that of gas, shall be as cheap, or cheaper, and shall be as easily manageable. If they can do that, they will make a great deal of money, provided the cost of production is less than that of gas, or no more.

But just here is the trouble. What is the light going to cost the producers? That is the question.—N. Y. *Sun*. April 2.

The Liegel Furnace.

To the Editor American Gas Light Journal:

In your issue of February 2d, you copy, from the London *Journal of Gas Lighting*, a description of a gas retort furnace, constructed by Mr. G. Livesey, at the Old Kent Road station of the South Metropolitan company. The characteristic feature of that furnace is a slot at the bottom of the fuel-bed for the admittance of the primary air-supply. But this is no novelty. The slot at the bottom of the fuel bed for the admittance of the primary air supply was patented in England, 1877, to Mr. G. Liegel, of Germany, and his generator furnace, as it was built then, is described in the London *Journal of Gas Lighting*, September 17, 1878; it was patented also in the United States, September 17, 1878.

We should have called your attention to this sooner, but wished to communicate with Mr. Liegel before doing so. Yours truly,

Eppelsheimer & Huttner,
U. S. Agents for G. Liegel.

—*Adv.*

Suffocation by Gas

A stranger called at the Bowery Hotel, on Saturday, and applied for a room. He registered as John Smith, and immediately retired to a room on the third floor. The only question he asked of the clerk was whether there was a gas light in the room, and on being informed that there was he appeared satisfied. He was not seen about the house during the morning, and at noon yesterday the chamber maid, on going to the room, found it locked. No response was received to several raps for admission, and the door was then forced open. The room was filled with gas, which was flowing from the burner that had been turned on to its full capacity. The occupant was found lying dead in the bed. He was apparently about 35 years of age, and had black hair and mustache, and dark eyes. His clothing consisted of a well-worn dark suit and ordinary underclothing. Seven cents were found in his pockets, but nothing was discovered to give any clue to his identity. It is believed that he committed suicide. His body was removed to the Morgue for identification.—N. Y. *Times*.

[The gas in this instance was illuminating gas made from caking coal.—Ed.]

Asleep with Unlighted Gas Turned On.—Gustave Bertlein, a German bookkeeper in the employ of Herman Freund, 98 Broome street, went to bed at 310 Broome street, on Thursday night, and after turning off the gas accidentally turned it back. He was found on Friday afternoon in a state of asphyxia, and he died on Saturday.—N. Y. *Sun*, April 4th.

Edison Tries His Lamps.

Mr. Thos. A. Edison, who removed his headquarters from Menlo Park to No. 65 Fifth avenue about six weeks ago, lighted up his new offices last night with his incandescent lamps. That it is difficult to introduce the electric lamp into old houses is shown by the obstacles he has had to overcome. Lengths of flooring had to be taken up in all the rooms and halls to lay the wires. The two wires forming each circuit had to be kept the requisite distance apart—about two inches—and after several attempts it was found that the only mechanics who could do the work were men who made a business of putting in burglar-alarm devices. Then it was found that in screwing on the lamps some of the wires had been so badly twisted as to break the circuits, and the electric current, instead of lighting the lamp, charred the wood with which it came in contact. Two Otto gas engines were put in the cellar to furnish the current, but after experiments with them had led to several explosions which shook the house and frightened the inmates it was found that the current supplied was so uneven as to give a very unsatisfactory light. The gas engines had to be removed and a steam engine was introduced, which, after sundry repairs and alterations, the clearing out of flues and the extension of the chimney works to the entire satisfaction of the inventor. One hundred lamps have been put in the building.

The light is the same in quality as that exhibited at Menlo Park, a steady, mellow white light. Only the main floor was lighted with the electric lamp last evening. To-night about sixty lamps will be lighted.—New York *World*, April 5.

[Official Report.—Continued from page 156.]

Eleventh Annual Meeting of the New England Association of Gas Engineers.

Held at Boston, February 16th, 17th, and 18th, 1881.

GAS STOVES.

The Secretary—At the last annual meeting of the Association there was a good deal said upon the subject of the use of gas for heating and cooking. Mr. Goodwin is here, but he says he has nothing to say to-day. The most sanguine hopes were entertained that the consumption of gas for cooking purposes would be greatly increased. In my experience such has not yet been the case. I have not been very successful in disposing of gas stoves, nor in the use of them for heating and cooking. Some gentlemen have been more successful. Mr. Taber has been able to effect a large sale of gas in that way. I hope he will give us the result of his experience.

Mr. Taber—During the year 1879 we let and sold for cooking and heating purposes about 100 gas stoves. I took off a record of 45 persons to whom we have sold gas stoves during the year. They had consumed, according to the meters, since they commenced using the stoves, 138,000 feet of gas. In the year previous those same parties had consumed 50,000 feet of gas in four months. Granting that the stoves were generally in use for five months, the average consumption by each gas stove during the summer was 2,500 feet. I suppose that we have now every year about 150 of those gas stoves at work, which at that rate would bring us a revenue of about $1,000 a year.

The President—Do you let the stoves?

Mr. Taber—We let the stoves, and think that we are not in any way worse off for letting them. We let all sizes and descriptions of stoves. We get as the rental for 64 gas stoves $160 per year. The depreciation of 10 per cent. would be $64, and the interest and expenses would bring it up to $152. Probably the gas stoves do not bring us in much as profit on the rental, but the consumption of gas is a little larger than the average consumption of each consumer in the summer months of the previous year. It is about equivalent to adding so many consumers during the summer months Every one who has tried it seems to be entirely satisfied with the result. I was amused with one person who had usually paid a stove rent of $9; she wanted us to leave the stove in, as she would use it again. She was a thorough convert to the utility of gas stoves.

The Secretary—In a company I am connected with (not the Charlestown Company) there was quite a large cooking stove put up for a party, and unfortunately the stove exploded one day and was ruined. That, however, did not dishearten the person using it. He sent to the office of the company and stated that he must have another stove notwithstanding. Another stove was procured and put in position, which I hope will not explode. He said that in spite of the explosion he intended to continue the use of the gas stove.

Mr. Stiness—Was not that explosion the fault of the operator in allowing a large quantity of gas to accumulate in the furnace before applying the match?

The Secretary—I think it was occasioned by carelessness.

Mr. Scott—My wife had a little experience with a gas stove. I cautioned her to keep the stopcock turned under the oven when not in use. She omitted one day to close one that went into the oven, and was using one of the others. She soon had an explosion. The only damage it did was to blow the door open and frighten her considerably. She probably will never leave the cock open again.

The President—Our friend Goodwin annually accumulates a large stock of knowledge relating to experiments with gas stoves, and I doubt not he can give us some facts which will be very interesting.

Mr. Goodwin—As usual, extreme modesty—

The President—I quite forgot to state that this is the *modest* partner. He comes forward with a declaration of modesty to start with. I was informed by the other partner a while ago that if Mr. Goodwin was to be called upon he should be called as the "modest partner," and I forgot to give him the proper epithet. I hope he will excuse me.

Mr. Goodwin—I was about to remark that my extreme modesty tends to keep me silent upon such an occasion as this, particularly in the presence of the other member of the firm.

The President—He has gone out now. We got him to go out, so that you could speak.

Mr. Goodwin—I heartily appreciate the kind invitations which I have received for several years past to be present at these meetings. Seriously, I feel embarrassed in being called upon to say anything upon this subject, as my remarks must necessarily reflect more or less the business in which I am engaged. I am human, and I cannot help making those reflections. You were speaking of explosions in gas stoves. There is a great deal of energy in gas, as the parties who were subjected to the effects of such an explosion probably realized. I have recently been testing some small gas engines in order to get at the amount of energy in a foot of gas, and if you would like to hear something on that subject I can give you the results. I imported several small engines from Europe, the Bischoff among others; and last week I made a test of one that is called a one-man power engine. It made 150 revolutions per minute, with a consumption of 18 feet of gas per hour, and gave 5,775 foot-pounds per minute. Working it out according to the regular equation for determining the horse power, and calculating that six men are equal in their labor to one horse power, it was .050 over it—showing that the people on the other side have not overestimated its capacity. I made a calculation as to the cost of running such an engine for a day. It would consume 180 feet of gas in 10 hours; the price, therefore can be readily determined in your companies. The amount of work that one of these gas engines could develop in one day would be equivalent to lifting 1,540 tons of 2,240 pounds one foot high in 10 hours, or in 1 hour 344,900 pounds would be lifted one foot high, with a 1-man power engine consuming 18 feet of gas per hour. I made a calculation this morning by way of comparison between that and the Otto engine. The latter consumes 21 feet of gas per hour, which is equivalent to .023 of a foot of gas to lift a ton one foot high.

The Secretary—What size of engine?

Mr. Goodwin—That does not make any difference; I am speaking now of the horse power. The Bischoff engine would require .116 ft. of gas to lift a ton one foot high—proving that small gas engines do not develop as much energy or power from a given amount of gas. That is about the difference between the Otto engine and the Bischoff engine, which is considered at the present time the most complete engine for small powers. It certainly is a very excellent engine for such work as pumping, running sewing machines, etc., and there are many similar uses to which it can be put. If you will just think that 1,540 tons can be lifted one foot high in one day of ten hours, with a consumption of 180 feet of gas, you will see that there is considerable energy in that amount of gas; and it is not to be wondered at that when an explosion takes place people get out of the way. Within the past ten days we have sent to a mill in the State of Massachusetts a furnace to be used for tempering. I was called upon by the proprietors of a large cutlery establishment in this State to see if I could get up a furnace which would temper knife blades successfully. After considerable expenditure of time, patience, and money we produced a furnace about 16 inches long and 3 inches high in the clear, in which we placed 8 atmospheric burners. I can hardly explain to you the arrangement of the chamber without a diagram, but I will say that the result is that the furnace is capable of tempering more knife blades than any one man can possibly handle. I was afraid that it would be too small. The consumption is about 30 feet of gas per hour. The furnace holds eight pairs of tongs, each pair of tongs holding two blades; and from the time of commencing to temper at one end until the other end is reached is about 45 seconds, and in this time will elevate the temperature of these blades to a tempering heat. Eight divided into 45 seconds gives a little over 5 seconds in which he has got to handle each pair of tongs. This furnace is to take the place of a much larger one. Here you see a new application of the use of gas.

I remarked at the last meeting of the American Gas Light Association that we had been called upon to design some kind of an instrument for sweating tobacco. We have recently put up two machines that will heat and maintain the temperature of the rooms at 145 degrees for a month without any intermission, provided the gas comes through the pipes, and without a variation of over 2 or 3 degrees either way. One room is about 30 × 10 feet, and about 8 feet high. The tobacco is put into boxes, in which it is sweated; and to do that the room has to be kept at this temperature and filled with steam. That is another use to which gas has been put.

I made some remarks at the last meeting of the American Gas Light Assoctation with reference to the heating power of gas stoves. During the recent cold weather I verified some of those tests. I took a day when the the thermometer was below the freezing point, with no fire anywhere about the room, so that the result obtained should be entirely from the gas. And I think I have demonstrated that the larger the stove the more heat you can get from a given quantity of gas. For instance, a stove 8 inches in diameter in 30 minutes elevated the temperature of the room 13 degrees; while a 14 inch stove elevated it 28 degrees. To be sure, there was more gas consumed in the larger than in the smaller stove, but the percentage was decidedly in favor of the larger stove. Reversing the proposition, and taking a given quantity of gas, we found that 6 feet of gas in the 8-inch stove elevated the temperature 15 degrees in 45 minutes, and that the same quantity of gas in the 14 inch stove elevated the temperature 24 degrees in 22 minutes. As I have before remarked, in my judgment it is entirely wrong to undertake to heat a room with a gas stove unless you have some means of carrying off the products of combustion.

I have been asked what difference there is between a gas stove using an atmospheric burner and one using a reflecting burner, which burns the gas

in its illuminating form. I can say that our tests have demonstrated, so far, that the result is largely in favor of the illuminating form. The stoves that we have recently made are constructed so that they give off three different forms of heat. First they give off the heat of radiation. Gentlemen are probably familiar with the fact (or some may have forgotten it) that heat is radiated is straight lines. You may easily prove this by taking two mirrors, say 13 inches in diameter; place them 30 feet apart, and put in the focus of one of those mirrors any substance that will give off heat (a ball of heated iron, for instance), and then put some gun cotton in the focus of the other meter, 30 feet off. Just so soon as you bring those two mirrors in a position where a line will pass through the focus of both of the mirrors, the gun cotton will explode. That certainly proves that heat goes in straight lines. That is one form of heat, and that is the form of heat that you get by the use of the atmospheric burner stove. If you use a reflector with the illuminating gas you also get the heat of reflection. Heat is governed by the same laws as light; the angle of reflection is equal to the angle of incidence; and if your stove is so constructed that the light is thrown down on the reflector at a proper angle, it will be reflected in straight lines into the room, and you will feel the reflected heat a number of feet away from the stove. Another source of heat is called the heat of conduction. The stoves are constructed so as to carry in at the bottom a certain amount of air, and as it passes through the drum of the stove the air is elevated to a temperature of about 280°, and is then thrown out into the room. You therefore get from this particular kind of stove the three sources of heat, which you do not get in the atmospheric burner stove, unless it is constructed upon the principle of the Adams stove. I made a stove after that pattern recently, and not having the fire-clay burners, nor time to get them up, I constructed some brass ones. In attempting to use them, our brass burners were melted in a very few minutes—the heat was so intense. We are now having some clay burners made, and will put them into this stove and test it. It is claimed that that stove will produce more heat per foot of gas used than any stove that has ever been constructed. I hope in the course of a few weeks to be able to determine that question.

The President—Can you give us the theory of the combustion which produces such an intensity of heat?

Mr. Goodwin—It is claimed that it is because of the large surface of the stove exposed to the heat. In the Adams stove there is about 45 feet of surface. It has several channels passing up and down and through it, which the other stoves have not; and, as remarked, the greater intensity of heat, it is claimed, is due to this larger surface. I do not know that I can add anything more to what I have said about gas stoves and gas engines. I shall be glad, however, to answer any questions, and I thank you, gentlemen, for your courtesy.

Mr. Nettleton—I would like to inquire if Mr. Goodwin can give us the cost of the Bischoff engine?

Mr. Goodwin—From $125 to $175, according to the size. A 1-man power costs $125; a 1½-man power, $175. I have also tried the Turner engine. These are the two engines that have thus far developed the most power.

Mr. Nettleton—How large are the largest engines built?

Mr. Goodwin—About a 4-man power is the largest. I will say, with reference to the Bischoff engine, as of all these small gas engines, that the great objection to them is the noise that is produced when the gas is exploded. With the Bischoff engine there is very little noise if you will be particular to keep the oil out of the cylinder; but the construction of the engine is such that it is almost impossible to keep it out entirely. Just so soon as oil enters the cylinder it begins to crack and snap with a report like a pistol. But, barring the noise, this engine is about as complete a little thing as has been gotten up, and they will do the amount of work that I have mentioned. You can run them up to two hundred revolutions per minute.

Mr. Nettleton—Are they as well made as the Otto engine?

Mr. Goodwin—I do not think that they are. On the American system of making things by machinery, I have no doubt that they could be very greatly improved and furnished for a less sum of money. The engines cost me more than I have indicated, but they can be made and sold in this country at a fair profit for $125 for 1-man power, and $175 for 1½-man power.

Mr. Coggshall—A 1-man power is about one-sixth of a horse power.

Mr. Goodwin—Some say it is one-fifth, and some that it is one-sixth.

The President—In exploding gas to obtain power in that way do you imagine that there is any gain in the greater superiority of the illuminating power of the gas?

Mr. Goodwin—I should think that to a certain extent there was; beyond that, there is not. I will state that there is a new company recently organized within a short distance of New York city, who have put up works for manufacturing what they call heating gas. The question has been agitated whether they could use the gas engine with that gas. They had put in place an Otto engine, and while I was there they started it. I had no way of testing the amount of work it could do, but it seemed to work quite as well as an engine that was supplied with 16-candle gas. Of course, it could not be told for a certainty whether it could do the same amount of work until properly tested.

The President—You mean that the explosion would be on account of the union of oxygen and hydrogen, but that the hydrocarbon which gave the illuminating power would not develop much energy under the piston.

Mr. Goodwin—I cannot speak from my own knowledge, but it would appear from my reading of the European tests that the illuminating power does improve it materially.

The President—I regret, gentlemen, that an imperative engagement will compel me to leave this afternoon, and I shall be unable to attend further sessions of the Association. The duty of presiding at the banquet will therefore devolve upon the first Vice-President. I know that he will do the honors of the occasion with becoming grace.

I want to state, in closing the session, that I very earnestly desire that the interest in the meetings shall not be allowed to flag. If each of you will consider your individual responsibilty in the matter, the success of the next meeting will be assured. If you will only reflect how much each of you can contribute toward sustaining the interest of the meeting, I know that you will make the necessary effort, and not let somebody else make it for you.

The Association then adjourned until the following morning at 10 o'clock.

Third Day—Morning Session.

The Association met at 10 A.M., Vice-President Slater in the Chair; and adjourned to the works of the Boston Gas Company. After visiting the works the members assembled in the office for informal discussion.

IRON SPONGE.

On motion of Mr. Harbison Mr. Connelly was invited to address the Association upon the subject of iron sponge purification.

Mr. Connelly—I did not come prepared to address you on the subject of iron sponge, but if any gentleman desires to ask any questions I shall be pleased to answer them. I understand that quite a number of gentlemen have been using it for some time, and no doubt their experience would be interesting.

Mr. Stiness—I would like to ask a question or two. I used the iron mixture of Cartwright and St. John for two years, and was pleased with it. I would like to ask Mr. Connelly if in working his material he uses any ammoniacal liquor, if he has had any experience with that, and if he considers it beneficial in the first using of it. That was the plan recommended to me, in the first using of it, by the parties in New York. Or does he wet it down with clear water?

Mr. Connelly—I use ordinary clean water. Our only object in that is to keep the dust down and make it more pleasant for the men to handle. During the winter season we do not dampen it at all, but during the summer season, when the boxes are not changed so often, and the material is allowed to lie out on the floor from one to two or three weeks, the atmosphere dries it, and makes it unpleasant to handle.

Mr. Slater—In what shape is your iron?

Mr. Connelly—As it comes from the furnaces it resembles ordinary gas coke in shape. We then crush it and mix it with sawdust, to lighten it up and make it more porous; and it is furnished in that shape. It has just about the consistency of slack lime. It offers about one-half of the resistance to gas that the slack lime does.

Mr. Slater—Do you consider it advantageous to use it in very thick layers?

Mr. Connelly—Yes; we are now recommending its use in one layer only. We formerly used it in two layers. In some works they are using it in one layer of 22 inches.

Mr. Slater—Do you consider that one layer of 22 inches would be better than two layers of 12 inches?

Mr. Connelly—Yes.

Mr. Greenough—How much will it purify?

Mr. Connelly—The result varies more than it does with lime. We have in the neighborhood of 50 works running with it, and they vary from 6,000 to 16,000 feet to the bushel.

Mr. Greenough—How long does it take to oxidize it after you get it out of the purifiers?

Mr. Connelly—Ordinarily from two to three days. In some cases, where they have kept it clean from the start, it will be in a shape to go back again within 36 hours; but we usually take from two to three days.

Mr. Slater—What percentage of carbonic acid do you find generally where you consider they are using it properly?

Mr. Connelly—From 2 to 2½ per cent.

Mr. Slater—How much sulphur?

Mr. Connelly—In a majority of cases they make no test for sulphur; but I think it varies from 13 to 18.

Mr. Allyn—In a majority of the works using it now do they use lime in connection with it?

Mr. Connelly—I only know of 4 works out of 54 where they are using lime in connection with it.

Mr. Harbison—Does it affect the candle power?

Mr. Connelly—I have not heard that it does in any of these places.

Mr. Jones—Our experience is that on the average there is a loss of about 2½ per cent. of candle power.

Mr. Connelly—In a majority of works where they were using lime before they claim that they can distinguish no diminution in the candle power by the ordinary tests.

The Secretary—You are aware that by the State laws we are restricted to 20 grains of sulphur; but the last test made by the State Inspector, a few days ago, gave me 23. If there are three errors in that direction—three cases of excess of sulphur—we are liable to a fine. Do you think that your process will, after the purifiers have been charged a few times, give an excess of sulphur?

Mr. Connelly—No, sir; we feel quite confident that a change in the method of handling the material at your works will bring the sulphur down to as small a proportion as you had before, if not less. I will explain that we furnished Mr. Neal's works a few weeks ago; but through a misunderstanding of the directions, the man in charge of the purifying department has not been handling the sponge as it should be handled. He had been making it wet, whereas we do not dampen it at all. Making it as wet as he did, it reduced the purification to about 2,500 to 2,700 feet to the bushel. He is now working it as it should be. Mr. Neal now asks if I think that the change in the method of handling will bring it up to the work at other places. I think it will.

Mr. Greenough—How long has it been going, Mr. Neal?

The Secretary—Since January 20. After the sponge was put into the purifiers I found that it did not do the work that I had expected of it. We thought that perhaps the purifiers were changed too often. I directed my superintendent to wet down the sponge. In its dry state there was no back pressure at all. It did not seem to me that there was enough back pressure, so far as the purifiers were concerned. He wet it down very thoroughly and tried it again, but with no better result. I asked Mr. Sprague, the agent, to send Mr. Connelly over and let him direct things with regard to the purification, and he has done so. I have here a statement, kept by hours. I commenced charging with 75 bushels of sponge. My purifiers are 10×16—rather small. We used 75 bushels of sponge for 5 consecutive days. Of course, we had two purifiers of lime at first; after the first charge, one purifier of lime, and then all sponge.

Mr. Slater—Is that the full charge—75 bushels?

The Secretary—Yes. I must say that the printed directions were not very explicit, and could be easily misunderstood; so that we were working somewhat in the dark. In 18 days we used 942 bushels of sponge, 406 bushels of lime, and purified at the rate of 2,750 feet per bushel. A month before that I was using lime alone, and purified over 5,000 feet per bushel on the average. Of course, I have done better than that. So you will see that our first results from the use of the sponge were quite unsatisfactory. But I do not say anything against the sponge. Its efficiency is said to improve as it is longer in use.

Mr. Stiness—Did you put it in in layers of three inches.

The Secretary—I did at first.

Mr. Connelly—It was the lime that you were using in layers of three inches?

The Secretary—Yes. After a few days I commenced to put in 81 bushels of sponge, and I used 58 bushels of lime. I have been in the habit lately of using 58 bushels.

Mr. Harbison—Are you using the sponge now in connection with lime?

The Secretary—Yes. This statement only goes to February 7. I have turned the matter over to Mr. Connelly entirely, and he can take up the subject where I leave it, and state what he has done to effect an improvement.

Mr. Slater—You say that it gave you 23 grains of sulphur. In what form did you find that?

The Secretary—I do not know; I merely received a line saying candle power so much; sulphur, 23.28 grains.

Mr. Harbison—Up to the 7th of February you put your lime in three inch layers. In what thickness of layers did you use your iron sponge at the same time?

The Secretary—I think we had two layers of sponge, and used 81 bushels in two layers, in 10×16 boxes.

Mr. Stiness—But how thick were the layers of iron sponge?

The Secretary—There were two layers of 6 inches of sponge. The 942 bushels of sponge and 406 bushels of lime used in 18 days averaged 2,750 feet to the bushel. That is not enough.

Mr. Harbison—Do you put the lime or the sponge on the bottom tray?

The Secretary—I believe I am entirely misunderstood. I used the sponge by itself, and the lime also. I found that the purification was going on too rapidly. I was not getting the right results. Then I charged the boxes with lime alone. I did not mix it at all; so that I charged five purifiers with sponge and one with lime; then two with sponge and three with lime; and so I changed every day.

Mr. Connelly—I will state that Mr. Neal was not furnished with a sufficient amount of sponge for his works. He was not able to allow the sponge to lie out long enough to be thoroughly revivified; consequently it went back into the box somewhat foul. I will also say that when beginning to use the sponge it does not usually purify more than 1,600 to 2,000 feet. That is the result of the first round in nearly every case. Then it increases. Perhaps the next round it will purify 2,500 or 3,000 feet. It increases until it gets up to an average of 8,000 feet to the bushel. In some instances it goes considerably higher.

The Secretary—What change did you make in the arrangement for purification at my works?

Mr. Connelly—At your works we placed sawdust underneath the sponge, and put it in layers of double the thickness it was used before. It is in one layer of 15 inches now. It is also going back into the boxes without dampening at all. It retains only the moisture that it obtained from the gas. I am satisfied that with these changes it will bring the purification up to 6,000 or 7,000 feet to the bushel. I believe you said that you were purifying 5,000 feet to the bushel of lime?

The Secretary—Yes; between 5,000 and 6,000.

Mr. Connelly—I do not consider that Mr. Neal's experience—starting off in the way he did—is any test of the efficiency of the material. The cause of his trouble was in starting off without proper instructions.

Mr. Greenough—Is it possible to revivify that material in the boxes without taking it out?

Mr. Connelly—We conducted some experiments last winter at the Pittsburgh works with that object in view. We purified, or revivified, seven boxes in succession without taking it out—varying from 15 to 22 hours. The process was simply the introduction of air into the bottom of the box, and using the steam heat to force the air through. The lid was left off entirely, and after passing the air and steam through for 15 or 20 hours, it had recovered its natural color; and then we put the lid on and let it rust until it was proper to re-turn it again.

Mr. Greenough—I suppose it got pretty hot?

Mr. Connelly—It got pretty warm, but not hot enough to ignite until the fifth or sixth box. Then a little smoke was noticed in one corner of the box. That was what had been expected from the start. We calculated that by introducing the proper amount of steam we could keep enough moisture in the material to keep it from igniting; and after running the fifth or sixth box we thought we had accomplished it.

Major Dresser—By "the fifth or sixth box" do you mean the fifth or sixth revivification of the same box?

Mr. Connelly—No; he commenced to revivify one without removing the material, and then the next, and so on around the set. After going around the set he commenced a second time on the first box.

Major Dresser—How many times did he revivify any one box?

Mr. Connelly—I am not familiar with that. I think that after the first discovery of its heating too much he revivified the same box three times without taking the material out.

Major Dresser—When he finally took it out, was the the material then used as long as it could be used? Had it acquired sulphur enough to require to be worked over?

Mr. Connelly—Yes, sir. Of course, he did not know but that there was some fire lurking somewhere else, and to make sure he emptied the box and examined it; but that was the only place where the fire was found.

Major Dresser—Did he use the same material any more after that?

Mr. Connelly—Yes; he put it right in next time. Then he ran along for five or six boxes more, and each time he was reducing the time required to revivify. When he commenced, it required 22 hours to bring it back to its natural color and to throw off all impurities. He kept reducing it each time, until he had got down to 8 hours; then he discovered signs of fire (a blue smoke) when he had been forcing the air through for 5 hours. He of course took the material out of that box, and examined it to see if there was any other trace of fire in it. Then he ran six or seven boxes more without any fire. But the evidence of fire at those different times convinced us that we could not depend upon that process regularly. Our object was to recommend its use in works where they had no room to spread the material, and to give a guarantee that they could revivify it continually in the box without having to take it out.

The Secretary—Has that been abandoned at Pittsburgh?

Mr. Connelly—No; at intervals he still revivifies in the boxes. He has ample room to take it out. His only object in doing it in the boxes is to save labor. It costs him about $18 to empty and fill a box. Of course, every time that he is able to revivify it without removing it there is just so much saved.

Mr. Lamson—You say that when the material is first put into the box it is less efficient than it is the second time. Do you mean that it increases in efficiency each day?

Mr. Connelly—Yes.

Mr. Lamson—Is that so every time that you have to cleanse the material? When you put it back again do you have to go through the same thing? Is it less efficient the first day, more efficient the second day, etc.?

Mr. Connelly—No; that is true only of the first four or five changes; then it gets up to its maximum work, and it continues at that for about two years. We have furnished it to some works where it has been used for two and a-half or three years.

Major Dresser—What is the longest time that you have used it in any one place?

Mr. Connelly—The same material for three years and four months, right straight along.

Major Dresser—What was the percentage of sulphur in that material when you had used it so long?

Mr. Connelly—We have just submitted a portion of that material to a chemist in Pittsburgh, but have not a report of it as yet.

Major Dresser—Had the material at that time done all that it would do satisfactorily?

Mr. Connelly—Yes.

Major Dresser—Would you mind giving a description of the way in which this material is manufactured originally—beginning with the getting of the ore out, and stating what kind of an ore it is? I mean in a general way, without going into any secret details. What kind of ore do you use?

Mr. Connelly—We use different kinds of ore. There is no particular kind that is necessary. My brother attends to the technical part of the work, and I am really not enough posted as to the details of the manufacture to give you that information.

Major Dresser—In a general way, it consists simply of roasting this ore?

Mr. Connelly—Yes; in roasting the ore, throwing off the volatile matter, and reducing it to this spongy condition. It is then crushed, mixed with sawdust or other material to lighten it up, so as to offer as little resistance as possible to the gas.

Mr. Slater—Is Mr. Young, of Allegheny, still using it?

Mr. Connelly—Yes.

The Secretary—I wish to say that this first test by us must not be considered against the process. The conditions were unfavorable, and the method pursued was not according to what is required, as I have since learned. I like it very much indeed. The method is more simple, involves less labor and expense in the end, than the use of lime. I have for some years bought the shells from which we manufacture the lime for 2 cents per bushel. This year I have to pay 2½ cents per bushel. My lime kiln is a long distance from the purifying house, and it is out of doors. The lime is stored in sheds after being manufactured. It has to be wheeled across the yard in all weathers. Then, when the boxes are emptied, the foul lime has to be carted away and used for filling. The sponge material is taken from the box and put in a shed adjoining the purifying house, there revivified, and then taken back again. The men are not obliged to go out of the building at all in its use. I hope this material will be effective, and do all that is claimed for it. If it will purify 5,000 feet per bushel, I will be well satisfied. My superintendent said he would be satisfied with it if it would purify even 4,000 feet. I shall give it a fair trial, under the direction of Mr. Connelly—and I hope most earnestly that it will succeed.

Mr. Allyn—In revivifying this material is it necessary to spread it out over a large surface, or can it be left in heaps?

Mr. Connelly—We usually spread it in layers of from 12 to 15 inches in depth. If it is spread much less than that it does not generate sufficient heat to throw off its impurities. At least, the action is much slower.

Mr. Lamson—As to the increase in the value of the material—do I understand you to say that when you put the material into the purifier it will purify, as in Mr. Neal's case, 2,000 feet to the bushel; that it will then go on and do that same amount for so many days, and that the next time you put it in it will purify 2,500 feet? Or will it purify 2,000 feet the first day, 2,500 the second, and so on?

Mr. Connelly—With each change; that is, each time that the same lot is used, after each revivification.

Mr. Lamson—And do you say the thing works better the deeper it is? At 22 inches do you get better results than at 12 inches?

Mr. Connelly—That has been our experience.

The Secretary—I made an error in putting it only 15 inches deep, from misunderstanding the directions.

Mr. Connelly—Our directions state that it can be used in two or more layers of from 7 to 15 inches deep. Those directions are not always understood. In some works, where they have a very large purifying surface for their production, considering the cost of the lime, it would not pay them to put their material in their boxes in 15 or 20 inch layers. We have supplied several works where one layer of seven inches in the box would be all that they could afford to use, and it would be sufficient to do their work. That is why we mention that a 7 inch layer will do in some cases. As regards the other directions—as to the handling of the material, etc., which Mr. Neal says were incomplete—I will state that the use of this material is comparatively a new thing, and we ourselves had much to learn by experience; and so from time to time we have made changes in those directions, as we found that they were needed. Mr. Neal was probably furnished with a copy of the old directions; and that was probably the cause of his trouble in starting with it.

Mr. Harbison—Do you know what is the size of the boxes used in Pittsburgh?

Mr. Connelly—They are 20 × 24.

Mr. Harbison—I ask that because I understood you to state the cost of charging the lime to be about $18.

Mr. Connelly—I understood that that was the cost of filling the box and emptying the lime.

Mr. Harbison—If he was using the sponge, what would it cost to take it out, handle it, and put it back after revivification? Does it have to be turned over more than once?

Mr. Connelly—He turns it only once. I understood from him that his labor was about 10 per cent. less in handling the sponge than in handling the lime. In some cases it is claimed that the labor is from 25 to 50 per cent. less, owing to the different methods of working it.

The Secretary—I consider it to be a great saving of labor.

Major Dresser—It would be a greater saving with you on account of your lime arrangement being such as to make it more expensive.

THE USE OF FOUL LIME.

Mr. Stiness—I was much pleased with a statement made to me this morning by Mr. Crafts, of Northampton, which was that he gets 6 cents per bushel for his waste lime—that the farmers use it. We would like to know how he manipulated it so as to get that price. We would be glad to get even half of it. With us, it is impossible to get rid of the lime, except by carting it away and dumping it. If there is a place where they are willing to pay that for the lime it behooves us to look around and see if we cannot find some value in it. I hope that Mr. Crafts will give the Association some light on the subject.

Mr. Crafts—We have been in the habit, for the past 15 years, of disposing of our foul lime to the farmers. We commenced selling to them at a time when they were all raising tobacco, and were seeking for all manner of fertilizers. The most successful way of using it is, during a light snow in the spring of the year, to spread it on the ground broadcast.

Major Dresser—How much to the acre?

Mr. Crafts—The exact amount I cannot give you; but a good, fair dressing, so that you can see it lying upon the ground.

Mr. Slater—You are speaking now in reference to what use?

Mr. Crafts—For grass, or for any other crop. Where it has been put on grains early enough, while there was plenty of snow on the ground, it would, previous to the melting of the snow, get the air sufficiently to carry away the gases, and the grain would not be injured. When put on later it would in some cases have a bad effect upon the grain for a time, but usually the grain would recover after rain.

Mr. Slater—Is that the way in which it is generally used? Have they used it in composts?

Mr. Crafts—They have used it in compost with muck and other soils. Those who have been most successful with it have been careful to use a layer of lime and then a layer of some coarse material like cornstalks or straw. I presume that the only effect of that is to let the air pass through it and rid it of the gases. They turn it occasionally, and the course material finally disappears. I think they generally put it in those heaps in the fall of the year, or early winter, and then use it the following season.

Mr. Stiness—Do you dispose of all the lime you have?

Mr. Craft—We have sold all we had, and we have never received less than 6 cents per bushel in the last 15 years. If I had your lime in my locality I could dispose of the whole of it.

Mr. Lamson—Every little while some man turns up here with a great scheme; he has an idea that he can enrich the whole of Massachusetts; he will make a bargain for a lot of lime, and he generally wants a little ammonia water to put with it. We always tell him that that thing has never succeeded; but he insists that he has got a patented process, and that he will make it succeed. He usually contracts for a car load, and is going to pay so much money. The result is a charge on our books for so much

money for so much lime. It may be paid for by somebody at some time; but the fellow never comes down for a second car load. Our lime is not so good as that which is turned off by most gas companies. If any of you get a chance to sell any lime, I advise you to get the money for it before it leaves the place.

Mr. Crafts—I have no doubt that you can sell your lime for some price if you can once get it introduced for use.

Mr. Fowler—Our farmers do not care to try it a second time.

Mr. Crafts—We have had the same customers for the last twelve years. Upon very heavy ground, where there are foreign grasses, and that are troublesome, by applying the lime and then ploughing it very thoroughly, they not only make the ground very much lighter, but they get rid of the troublesome grasses.

Major Dresser—Do you put the lime on before or after the ground is ploughed?

Mr. Crafts—Before.

Mr. Dwight—If you will put it on pasture land, where you have a green mold all over the ground, the field will appear as if a fire had run over the grass; but it will finally give place to a beautiful white clover. I have tried it on an orchard—putting stable manure on one half of the orchard lime on the other half, and then ploughed in the turf. I could not see but that the lime was as effective as the manure; it helped the apple trees and killed off all the vermin. Our people have used it in making a compost with leaves—putting the lime and the leaves in alternate layers. They use it to great advantage in that way. I give all my lime away; I cannot get 6 cents per bushel for it.

Mr. Slater—Some eight years ago a man in Providence, who had a large stable and a large farm, became very enthusiastic about using this spent lime. We gave him a thousand bushels, which he carted away. That year the net profits of his farm were very slight. It cost him considerable money to try the experiment, and he got discouraged and never tried it again.

Mr. Allyn—We had rather an amusing experience at Brookline. I had a number of interviews with a gentleman who cultivates an extensive vegetable farm, and tried to persuade him to use spent lime. I told him that I thought there was money in it if he would use it properly. Before the frost was out of the ground he applied 30 or 40 loads of spent lime upon a field of 5 or 6 acres, where he intended to have cabbage, and then in due time ploughed the ground and turned the lime in. The result was the finest field of cabbage that I ever saw. There was not another piece of cabbage in twenty miles that was not nearly devoured by the cabbage worm, but not a cabbage worm visited his patch. The neighboring farmers looked upon that cabbage patch with astonishment, and wondered why the worms did not destroy it. So pleased was my friend with the result of the experiment that the next year he went into the lime more extensively. He had a piece of mowing land of 10 or 12 acres, from which he had taken 40 or 50 loads of hay that year. He proposed to apply a dressing of lime to this field. I told him I thought it would be a mistake. He said he knew what it had done for his cabbage field, and it would do the same for his hay field. If you had poured sulphuric acid over the field, it could not have had a more disastrous effect than that which the lime produced. The grass disappeared.

On motion, a vote of thanks was passed unanimously to the officers of the Boston Gas Light Company, and to Messrs. Greenough and Lamson for their courtesy in showing the members of the Association through the works, and for the use of the office for this meeting.

The Association then adjourned *sine die*.

Another Rival of Gas.

As if the electric light were not formidable enough by itself, another competitor for public favor has arisen in the new process for lighting of which Colonel A. P. Chamberlain is the inventor. This novel process has been introduced into the engineering and boilermaking sheds of Messrs. Duncan, Stewart & Co., London Road Ironworks, Glasgow. The gas, or atmospheric light, as it is called, is produced by a process somewhat like ordinary coal gas. In the above works a furnace has been erected within a small shed, and outside the shed is a gasholder. The furnace contains three retorts, and these are supplied with a combination of mineral oil, water, and air, which enter through a small pipe carried from the back to the front of the retort, and the gas finds an exit through a large pipe at the back of the retort. The vapor is conducted to the purifier; thence it is carried into the gasholder, and then led through the old pipes in the works to the various machines and benches in the shop, supplying about 200 burners. The gas is said to give a whiter and more pure light than coal gas, or something between coal gas and the electric light. The odor is not offensive, and it is stated to be freer from deleterious effects on pictures and paper than coal gas.

The chief advantages claimed are simplicity of application to public works, country churches, schools, and mansions. The cost is said to be less than one-half that of coal gas. Though the invention is not likely to cause such a panic among gas shareholders as the development of the electric light recently did, there is much in the announcement of the new lighting agent to disturb their equanimity. However, further and fuller details are required before a definite opinion can be formed of the utility of the new gas.—*Iron*.

[From the London "Journal of Gas Lighting."]

The Transport of Materials for Gas Works.

ILLUSTRATED BY THE PLANS OF THE YORK, NEWCATSTLE-ON-TYNE, AND BECKTON GAS WORKS.*

By V. Wyatt,
Constructing Engineer to the Gas Light and Coke Company.

Introductory Article.

The conveyance of the necessary materials, such as coal, coke, lime and gas products, into and out of gas works, with the utmost facility, despatch, and economy, is of the first importance in the operation of a successful gas undertaking. This is equally as essential as is the efficient carbonizing of the coal in the retort house, the purification of the gas in the scrubbers and purifiers, or the manufacture of gas products on the site. Unless the supply and exit of the heavy materials used upon gas works be conducted with the best arranged modern appliances and plant, it will be next to impossible to conduct the business of a gas factory with regularity, economy, and order. With an ill-designed plan or arrangement of means of ingress and egress, there are endless and hourly blocks to the progress of the daily work in an establishment which should have its materials of manufacture constantly in transit to and fro during the twenty-four hours of the day.

An attempt will be made in these papers to describe, and also to delineate in the accompanying model plans, the arrangement of the buildings and structures of gas works, so as to ensure the necessary expedition and working of the establishment with equal facilities by night and by day. The plans selected for examples will be those which the writer has arranged and constructed for the new gas works of York, Newcastle-upon-Tyne, and Beckton; and these will exemplify most fully the wants of a gas factory to supply not only moderate demands, such as York, with its 60,000 inhabitants, but the wants of larger districts, such as Newcastle, with 200,000 inhabitants, and also the still larger wants of a Metropolis supplied to a large extent from Beckton. Taking these three examples for illustration, it will be convenient to commence my description with that of York, the more simple and economical of the series. This example is also the most modern of the three, as it was only conceived during the past year, and is still in course of completion. The site and works being of limited extent, it may convey to my readers a greater interest than the larger works of Newcastle and Beckton, which are undoubtedly beyond the requirements of most places. Before, however, describing in detail the York New Gas Works, it will be essential that I should explain a few general principles connected with the subject of transit of material to and from gas works.

In laying down a plan of modern gas works, the first consideration is naturally to utilize the site to the utmost, and at a reasonable expense, for the rapid and safe ingress and egress of heavy material. In doing this, recourse must be had to the most modern arrangement of structures, railways and plant in connection with the road, river and railway routes leading up to, feeding and relieving the works. The arrangement of plan will be rendered the more complete and efficient, if only the external aids of the road, the river, the canal, or the railway system exist near the site, and so that they can be worked in economically and with engineering success. A site for gas works is an unfavorable one in proportion as one of those means of supply and relief is absent. When these physical features are wanting, then some of them must be created at a certain expense, in order to make good the unfortunate position of site; such, for instance, as means of navigation, a branch railway to a trunk railway system in the district, a branch canal or roads. In the case of Beckton, there existed only the river in connection with the site, and this presented itself in an unapproachable and crude form, with its primitive and muddy tidal foreshores. The piers, quays, railways and roads had to be created and formed at a great expense, and the position was two or three miles from the civilized points of the Metropolis. At Newcastle there was the railway system and River Tyne in happy proximity to, and almost surrounding the site, and the works only wanted a small communication by road to bring the position into immediate use. At York the situation was equally fortunate, being surrounded by a combina-

* It is a fact not generally known, we believe, that the "Specimen Plan of Gas Works," issued by the Board of Trade, in 1870, attached to their "Regulations," for carrying out the Gas and Water Works Facilities Act of that year was prepared by Mr. V. Wyatt. It will be interesting to set this plan side by side with the three plans placed at our disposal by our esteemed contributor, and which will be given in subsequent numbers of the *Journal*, with the continuation of the article we have the pleasure to lay before our readers.—Ed. *J. G. L.*

tion of road, navigation and railway facilities, having direct communication with the North Eastern Railway system. The York new site is alongside of and touching by means of a bridge across the navigation and public road, the old gas works, forming, as it were, a connected establishment of old and new gas works in one manageable undertaking.

Human labor is a troublesome and costly commodity to deal with on public works and in factories. It has its strikes, whims, caprices, and Employer's Liability Act; its everlasting desires for an increased wage, whether earned, deserving, or otherwise, and its combinations for forcing up labor prices, and for doing the minimum of daily work for the maximum of daily pay. Therefore, the only conclusion that the manager of a gas works can come to, in the present state of the labor market, is that this same article of human labor should be dispensed with as much as possible in the establishment, and its place taken by machinery, plant, and special planning of the works to carry on the entire business. There being neither sentiment nor sinews in roads, railways, plant and machinery, the engineer need not have either compunction or thought, other than an economical use, how he works, wears away, and disposes of the same in order to attain his ends and purposes. The plans of gas works should, therefore, be so arranged as to embody and utilize the most modern forms of structure, machinery and plant for all the heavy work of the establishment, even assuming that the cost of machinery and plant is somewhat greater than in cases where the work is done with a large proportion of human labor about the concern. This extra cost is rarely incurred, excepting for small works and where the minor and complicated operations about a gas factory hardly admit of special plant and contrivances.

The plan of a gas works should exhibit on its face some of these four great means of access to and from the outer world of commerce—viz., railway, river, canal or navigation, and road. The greatest and most valuable of these is the railway communication, and it must be looked for and obtained even at what may be deemed considerable cost, otherwise the works will be isolated, left out in the cold, and in constant want of the necessaries of existence. In most situations one or more of these arteries of traffic can be commanded, and those works will be the most economically and easily managed which command the greatest number of these feeders of material. Generally speaking, in modern times, the railways are everywhere, or at least they are not far away from any habitable locality, and are in a position to be taken advantage of, utilized, and incorporated into the system of a gas works, either at a high level, to suit the storage of coal in coal stores or retort houses, or at the low level of the coke yards and firing floors, or even by a wise combination of both high and low level lines on the same works.

In adapting the railway system to gas works, the details need not be carried out in the costly form exhibited on most of the railways throughout the country, where may be observed the necessarily heavy and expensive permanent way and structures, to carry on a large and mixed traffic at excessive speeds up to 50 miles per hour, with all the accessories of heavy plant and equipments. An efficient railway system of a light character can be constructed, and is all that is wanted for sidings to gas works. The rails will be sufficient for this purpose if they weigh 56 lbs. (½ cwt.) per lineal yard of rail, instead of 75 to 84 lbs. as in the ordinary system of the country. They should be of the flat-footed type, not more than 4½ inches broad at the base, and of about the same height. They should be fished at the joints, which occur every 24 feet, by double fish plates, 18 inches long, weighing about 20 lbs. per pair, and secured to the rail with 4 bolts ¾-inch diameter, passing through ovalled holes to allow of moderate expansion to the extent of ¼-inch. The cumbersome cast iron chain, with its crude compressed wooden key, and fastening trenails and pins, peculiar to the English railway, and seen nowhere else in the world, should not be thought of for a moment in the railway lines and sidings of gas works. On the viaducts these rails are secured to longitudinal or cross sleepers, at intervals of three feet, by a pair of ¾-inch diameter wood screws or spikes, with about one-fourth of their number placed as through ¾-inch bolts, held firmly on the under side of the timber by washer fangs. The permanent way on the ground, or coke-hole level, requires the ordinary railway sleeper 9 feet by 10 inches by 5 inches, placed at 2 feet 8 inches centres, being 9 sleepers to a 24 feet rail. The sleepers and timbers should be soaked in a hot bath of creosote and thin tar for some hours before being placed in the work. The flat-footed rail is secured to each of the sleepers by two ¾-inch diameter spikes or wood screws, with four fang bolts to each rail, to keep the same in position, and to prevent sliding forward on the necessarily steep inclines which are inevitable in most gas sidings. In all cases it will be found advisable to use the steel in preference to the old-fashioned wrought iron rail, on the score of great capacity for hard rubbing and dirty siding work, and a perfect freedom from that great curse of all iron rails, the constant lamination of the heads of rails. The life of the steel rail is two or three times (some say ten times) as long as the iron rail; consequently, the roads are less interrupted for repairs and changes. The prime cost of the steel rail is but little in excess of the iron. The gauge of the railway should be the universal one of the country which for England is the well-known standard of 4 ft. 8½ ins., for the simple reason that the ordinary plant and rolling stock can be used and taken direct to any part of the gas works from any railway, colliery or works in the kingdom, and expensive transhipment of materials upon the site of the works avoided.

The cost of a lineal yard of railway, laid with rails of 56 lbs. to the yard, including sleepers, fastenings, ballast, and laying, is generally about 16s. This price assumes that the ordinary and expensive gravel ballast of railways is not used, but the pan and clinkered breeze of the gas works employed in its place. Where ballast brought from a distance is used, there will accrue the expense of £1 per lineal yard, all costs included. These prices will comprise the necessary points, crosses, switches, and other appendages to work the railway system, all articles being made to the light but not necessarily the weak patterns. These figures apply to low-level or ground lines, the substructure of which is earth or bank. With viaducts or high-level lines, the price per lineal yard will reach a higher rate, as the railway must be carried at varying levels, and with more or less of complicated details, to reach the coal stores inside or adjacent to the retort house.

The cost of a single line viaduct, to carry one pair of rails, standing on cast iron columns, having wrought iron girder superstructure, with moderate foundations, will be about £12 10s. per lineal yard, or £4 3s. 4d. per lineal foot, all included. For this sum a good substantial high-level viaduct can be secured, with a height above the coke yards sufficient to lead the coals to a store 14 feet in depth, and capable of carrying a light serviceable locomotive and train of waggons. It is well to have the viaducts sufficiently strong and stable, as the shunting and rough operations incidental to the working of all coal sidings act severely upon these structures. The height of 14 feet above the ordinary ground line is usually enough and to spare for the retort house stores when worked from the ground line. As to retort houses which have the accessories of coal and firing stages with coke-holes below, known as "stage houses," and as used in all modern large works, the height of coal delivery cannot be less than 21 or 22 feet above the ground or coke holes. The cost of a viaduct to suit these improved retort-houses will be about £15 per lineal yard, or £5 per lineal foot.

The railway curves and inclines leading up to the gas works can be laid down, if necessary, on a severe and sharp scale, as compared with the ordinary practice of railway engineers. Thus, for instance, the radius of a curve can be used here and there as sharp as 75 feet, and an incline as steep as 1 in 25. At Beckton, for some years, a temporary incline of 1 in 16 has been used, and done good service, effecting a communication between the high and low level railway systems and interchanging the traffic between the two levels. In the examples of works which are given in these papers, the exigencies of curve and gradient will be apparent. In ordinary railway work the engineer rarely uses a sharper curve than 10 chains radius, being equal to 660 feet, or a steeper gradient than 1 in 66, or 1 foot rise to a chain in length, having regard always to the speed incidental to the railway system, and the wheel base of the large type of locomotives used. The chief points to be kept in view in laying down sharp curves and gradients are not to make either of them too long, say not exceeding 400 feet; to lay the rails with rather a full gauge—say 4 ft. 8¾ ins. instead of the net gauge of 4 ft. 8½ ins.—to enable the wheel tires of the locomotives and waggons to adjust themselves the more readily to sharp curves; to have guard or check rails next the inside rail of all sharp curves, to prevent the wheels from mounting the rails and producing deadlocks; to have the rails well bolted through the sleepers at intervals with ¾-inch diameter fang bolts, alternating with the ordinary spikes and wood screws; and to super-elevate the outer rail above the inner one of the curve from one to four inches, according to the curvature.

A good rule to adopt in laying down sidings for gas works is never to introduce a turntable on the system, if it can possibly be dispensed with. The turntable involves breaking up the train into pieces, and hand shunting—a most expensive and slow operation, with its local delay and confusion. It will be noticed, in the examples given in these articles, that this item of railway furniture has been almost entirely dispensed with. I would advise all who have to do with railway communications to avoid, as much as possible, the turntable, with its accompaniments of hand and horse shunting, and the resultant tedious delays and stoppages.

The locomotive used for gas works sidings should be of a light, four-wheeled coupled type, and need not, when fully-equipped with fuel and water, exceed a weight of from 10 to 14 tons, according to circumstances, and for all ordinary appliances and works. Even still lighter locomotives can be used with advantage to the light-railed roads of works where there is a moderate make of gas. The wheel-base of the locomotive should be restricted to five feet long, centre to centre of wheels, which should be four in number, about 2 ft. 9 ins. diameter, and all drivers; the cylinders should be, say, 8 to 10 inches diameter and 18 inches stroke; and the consumption

of gas coke will be about 10 to 12 cwt. for ten hours' work. The cost of a locomotive of light make as above described, of best materials and manufacture, will be from £600 to £1000. It is preferable always to have a well-finished and perfect machine, and then will result minimum of wear and tear, and consequent repairs and delays in the repairing shop. The work on gas works sidings is rough and dirty, and all plant should be of the best and strongest kinds to resist the ignorant and too frequently brutal usage to which it is subjected in the continuous round of night and day work.

Second Article—York Gas Works.

[For illustration accompanying this description see London *Journal of Gas Lighting*, February 22d, 1881.]

In proceeding to describe the three examples illustrated, and detailed in these papers, the first taken will be that of York, including the railway system and communications for the combined old and new gas works. By an inspection of the plan accompanying the present number of the *Journal*, it will be seen that the old gas works are in close proximity to the new ones, being divided only by a navigation and a public road; and the two sites are joined together, and almost made into one, by the gas company's bridge, which crosses these thoroughfares. The old works are to the west of the new site, and are situated at Monkgate, near the Monk Bridge, York, and chiefly bounded by the Foss Navigation and public road over which the before-mentioned connecting bridge is placed. The old gas works have attained a make of 1½ million cubic feet of gas per diem, consuming about 150 tons of coal as a maximum, and having a yearly gross make of gas in 1879 of 220 million cubic feet, with a gross consumption of over 26,000 tons of coal. These works are now utilized to their fullest extent, and cannot be extended on the present site. The coal hitherto used at these works has been from year to year carted from the railway station, over the streets of the city, at a cost of upwards of 1s. per ton, including the necessary waste from double loading, exposure, cart transit, extra trimming in coal store, and other losses. The old works being insufficient for the growing demands of York, which has a population of about 60,000 inhabitants, the new site was secured, situated to the east of the Foss Navigation and the public road, and to the south of the Scarborough main road leading from York, between Monk Bridge and Layerthorpe. Upon this site are being erected the new works shown on the plan, and which when fully developed, will turn out an additional make of gas of 1½ million cubic feet per day of 24 hours; thus giving to the manufacturing power of the combined establishment of the old and new works a total yield of about three millions cubic feet per diem.

The means of communication for the transport of the coal and other materials into and out of the works have been laid out for the united accommodation, as before stated, of the old and new works. The coals and materials will, for the future, be mostly brought from the North Eastern Railway system, by means of the York Cattle Market branch, to which latter line, the works of the gas company are joined, to the east of the property, and distant about 130 yards from the new site. At the point of junction with the North Eastern Railway branch, parallel sidings have been put in for 20 loaded and 20 empty 10 ton coal waggons. The special line of railway built by the company for the use of their works, diverges from this point in a cutting, and goes by single line on to the viaduct across the site of the new works, through lands specially purchased, with curves of 330 feet and 500 feet radii, and a rising gradient of 1 in 40. It then passes over the new site on a level double-line railway viaduct for a distance of about 100 yards to the navigation, supported by cast iron columns, with 20 feet centres, or bays, the rails being 14 feet above the new formation or ground level of the new works. The line is then carried by a single-line wrought iron girder bridge across the navigation and public road by two spans, of 58 ft. and 3 ins. and 46 ft. 3 ins. each, when it enters the old site. This combined bridge is an essential and somewhat expensive part of the undertaking, as a headway of 16 feet had to be given to the navigation, and 14 feet to the public road; and a condition of its erection, on the part of the York Corporation, was that it must be of an ornamental character, and subject to the approval of that body. The bridge is now in course of construction with the other new works, and by wisely conceding to the wishes of the York Municipality in some matters of detail, and through the instrumentality of the late Lord Mayor, Mr. Wilberforce, the gas company have been saved the expense and worry incidental to a supplementary application to Parliament for fresh powers. This fact shows that all corporations and public bodies are not of an obstructive and perverse type, as is too usually assumed, for the above consent was graciously given by the York authorities without exacting the usual *quid pro quo* in money and other blackmail, so common to the inception and carrying out of public works. The bridge will connect the old and new works together not only for the purposes of transport of materials and railway communication, but also as an ordinary road access to and fro, and with the necessary means for pipes and mains to link together the factories of the combined undertaking. The railway, upon a single-line viaduct, is continued to the west of the bridge, on the high level, by curves of 100 feet and 75 feet radii, and on an incline, still rising, of 1 in 200, round the three old gasholders of the old works, and turning round north, and almost at right angles, it enters the old coal store, at a level of about 12 feet above the floor where the coal will be deposited for the use of the old works. This method of coal delivery will feed these works with the least possible interference with the buildings and mode of manufacture, and dispense with the present costly and inconvenient system of horse carting of coals, which has been carried on for so many years.

To return to the double line of straight viaduct across the new site, previously described; by reference to the plan it will be seen that there is a branch single-line viaduct which turns off at the east abutment upon a curve of 150 feet radius, which afterward splits up into two single-line viaducts, on reverse curves of 150 feet radii, entering the new retort house on each side, still at the high level of 14 feet above the ground line, and 13 ft. 6 in. above the firing floor of the retort house. The two lines will run the entire length of the new retort house, and put the coals under cover, in front of each face of the retort benches. The retort house being intended for the storage of coals as well as for carbonizing them, it has been designed 210 feet long by 110 feet in width. The viaducts upon the new site can be utilized as coal stores in the open, whenever it may be necessary, from increased manufacture, colliery strikes, or other causes, to add to the storage. Generally speaking, however, the coals will be used in a fresh condition from the colliery, as the means of communication will be direct, and almost daily with the northern and other coal fields, similarly to the prompt and rapid systems of delivery laid down for the Newcastle and Gateshead and the Beckton works, where the supply of coals has been likened to the coming in of the morning's new milk—constant and diurnal. In the York works it is intended in the future to construct low-level or ground railway lines, as shown by the dotted lines on the plan, descending from the high level or viaduct system at the east end, to transport the coke, materials for repairs, spent lime, and other products, so as to link in the railway system with the navigation quay and roads, and to utilize to the utmost extent the economical features of the new site.

The resultant economy to the Company by the introduction of the new transport arrangements will be immediately upward of £1,500 per annum for these moderately sized works, to say nothing of the facility, quietude, and certainty of the new system. The confusion and muddling together of waste, delay, dirt, horse and human labor, peculation, and worry with the "one-horse cart style" of delivering coals upon gas works, can only be understood and appreciated by those who have had the misfortune to carry out such a state of things year after year.

[To be continued.]

Gas Engines.

In the April number of *Van Nostrand's Engineering Magazine* will be found an interesting and instructive article on "Small Motive Powers," by Henry S. E. Shaw, C.E. We give below that part of the article which relates to the use of gas engines as motors:

Gas is a convenient source of power, and in towns, where it is already supplied almost to every building for purposes of illumination, it is at once obtainable in any moderate quantity. Moreover, the principle of adopting a large centre of supply, which is employed in the case of gas, is, on scientific grounds, truly economical, for that substance is supplied in the state of fuel, and involves no more loss in its transmission than would occur in the transference of any other fuel. But in spite of many attempts to use it for small motors, it has only recently been much adopted.

Air is used in a peculiar way in the gas engine, and it is only in a similar way that gas can be profitably employed, viz., as the working agent, at the same time as the source of power; for the calorific power of gas, taken in conjunction with its present cost, at once puts out of the question any idea of using it as a direct substitute for coal.

The original method of using gas in this way was to admit it to the cylinder of the engine, together with air in such proportions as to form an explosive mixture, which was ignited, and work obtained by the consequent expansion. Lenoir's engine, which was one of the first, resembled an ordinary horizontal engine, effecting the ignition by an electric spark; but the difficulty of utilizing this sudden effect was a cause of considerable loss, and it is stated by a German writer on the subject* that 3 cubic meters (about 106 cubic feet) of ordinary coal gas are required per hour per HP. for a small-sized engine. This corresponds to the figures quoted by Mr. D. K. Clark† from the experiments of M. Tresca, two successive trials of this engine, giving 112 and 97 cubic feet respectively, the mean of which is 104½ cubic

---

* "Klein-Kraft-Maschinen," p. 27. Von Peter Hell, Braunschweig.

† "A Manual of Rules, Tables," etc., p. 921.

feet per hour per HP. at the brake, being an efficiency of little more than 4 per cent.

Though this engine had an extensive sale in Europe, it was to a great extent superseded by the Otto and Langen motor. In this the sudden expansion of the gas was allowed to raise a piston against the pressure of the atmosphere alone, which pressure, upon the cooling of the heated gas in the cylinder, hastened by a water jacket, drove down the piston, and so performed work, the piston-rod being a rack which geared with a pinion on the horizontal shaft.

This engine is a regular and efficient motor, and its consumption of from 22 to 30 cubic feet per hour per HP. is vastly superior to the Lenoir engine, and is even less than in some engines which have superseded it. One engine, which has been at work for ten years in Bristol, is in good condition, and has cost during that period very little for repairs; but its noise in working is much against its general adoption. Again, it is necessarily a vertical engine, by no means so popular as the horizontal form, and is anything but compact.

Thus when the new engine of Otto was introduced into this country by the same manufacturers, Messrs. Crossley Brothers, Manchester, which was at once compact, economical, and, above all, silent, they almost at once ceased to make the Otto and Langen, and have already sold, since 1877, upward of 800 of what are known as the Otto Silent Engine, more than 2,000 being the number sold in Great Britain and on the Continent.

The principle of action employed, as indeed of nearly all the many kinds since patented, is intended to meet the difficulty of utilizing the energy of the gas consequent upon the sudden explosion in former engines.

The method of doing this is best stated in the words of the specification of the English patent, No. 2,081, 1876: "A combustible mixture of gas or vapor and air is introduced into the cylinders, together with air or other gas that may or may not support combustion, in such a manner that the particles of the combustible mixture are more or less dispersed in an isolated condition in the air or other gas, so that on ignition, instead of an explosion ensuing, the flame will be communicated gradually from one combustible particle to another, thereby effecting a gradual development of heat and a corresponding gradual expansion of the gases, which will enable the motive power so produced to be utilized in the most effective manner. The cylinder is constructed of greater length than the stroke of the piston, so that there is a space beyond the latter when it is at end stroke. Assuming this space to be filled with a portion of the gaseous products of combustion resulting from the last stroke, the piston, in performing one part of its stroke, draws in atmospheric air, after which it will draw in combustible mixture during the remainder of the stroke."

These three strata of gases are compressed in the return stroke, and ignited, when the principle above quoted comes into operation; and the next forward stroke does useful work, the fourth, or next return stroke, expelling the product of combustion. The slide valve is made alternative in its action by being driven through a bevel wheel on the main shaft of half the diameter of that on the slide valve rod. The mixture used is 1 part of gas to 16 parts neutral, the latter being made of air and products of combustion in the proportion of 5 to 3. Some recent inventors adopt the main principle involved, but they employ a separate compression cylinder, and by advertising a combustion at each revolution, seem to imply the alternate action to be objectionable; and it must be confessed that the Otto engine is not perfectly regular in its action with a light load, combustion taking place perhaps only once in five or six revolutions. At the same time, with a proper load and a moderately heavy flywheel, this is hardly appreciable, and is of undoubted benefit to the cylinder, which, being also single-acting, is thereby only heated once in four strokes.

One such engine has been running day and night at the Hinckley Gas Works for fourteen months, this being equivalent to three years' ordinary work, which, notwithstanding the water jacket surrounding these cylinders, is a satisfactory result, and is contrary to many predictions concerning it. Such a result may possibly not attend those burning gas at every revolution.

The latest trials of the amount of gas used are, according to Mr. Crossley, 24 cubic feet per hour per horse power for the 1 or ½-horse power engines, and 18 cubic feet for the 16-horse power engines.

Another engine, the Eclipse, of Messrs. Simon Beechey & Co., of Nottingham, with a separate compression cylinder, has a novel feature, in the use of steam, which is generated by the heat abstracted from the cylinder in order to keep it moderately cool. This steam is used in the cylinder not only to assist the action of the expanding gas—which it certainly does, being capable of driving the engine for several minutes after the supply of gas is turned off—but it also acts as a lubricant, by which it is claimed that a great saving in oil and tallow is effected. Its action is fully described and drawings are given in the *Engineer*, 1879 (Vol. xlvii., p. 3), and the *Textile Manufacturer*. May, 1879. In the former it is stated that in a trial of one the working cylinder, which was 8 inches in diameter, with 16 inches stroke, indicated 6.03 HP., and the compressing cylinder, which was 7 inches in diameter, with 10 inches stroke, indicated 1.87, leaving 4.16 HP. as the net indicated HP. of the engine. The consumption of gas was from 22 to 26 cubic feet per HP. per hour.

The objection to the foregoing type of engines is that they have to be started by hand and turned through a revolution or two, although the makers of the later engines are said to have obviated the necessity for this by an invention. With very small powers this objection is not felt, nor is it with a recent novelty—the Bischoff. This little motor, which is made from 1-man power upward, has had a sale of 300 during the first nine months since its introduction. The consumption of gas is greater in proportion than in other larger gas engines, but its first cost is very small, and being advertised to work for ½d. per hour, although by no means a silent engine, it has decidedly met a long-felt want.

The theory of gas engines is yet imperfect; but some things are certain with regard to them, and one is that the absence of a boiler in connection with them gives a great advantage over the steam engine. The absence of risk either from explosion or conflagration is another strong point; while the scientific application of production on a large scale, in the form of the gas used, is perhaps the strongest of all, in leading to the conclusion that their present popularity is likely to last, gas engines being a step in the right direction.

Southern District Association of Gas Engineers and Managers.

This Association held their Annual Meeting, on February 10, 1881, with the President, Mr. W. H. H. Broadberry, of Tottenham, in the chair. The address delivered by the Chairman contained a number of well-timed suggestions and criticisms, and we regret our inability to reproduce it in full. We make the following extracts in reference to the management of the

RETORT HOUSE.

"I have no doubt, gentlemen, that you are all familiar with the expression so often used, viz., that dividends are made in the retort house. This is true to a very great extent, for if there be mismanagement in this department, it is almost impossible to pay dividends, unless the price charged for gas be considerably more than the surroundings justify. But to manage a retort house, it is not necessary to be always there, neither is it possible to manage it properly without ever entering it, but much may be done by a judicious office management, and a daily comparison of the gas made in proportion to the coal used, and the illuminating power of the gas so made. If this be done daily, a falling-off, either in quality or quantity, will soon be discovered, its cause found, and the fault rectified.

"The retort house of to-day is a different thing altogether from a retort house of 25 years ago. Those of us who are old enough to remember one of that period, with its iron retorts, its old fashioned make of gas per mouthpiece, and per ton of coal, can and do appreciate the improvements made in the plant we now find in almost universal use. Fireclay retorts, the boon of to-day—with what suspicion they were received, and how universally they were condemned—the letters upon letters that were written to prove their uselessness are matters of history. In the present day a man would be looked upon as a madman who objected to their use, for it is entirely owing to them that we are enabled to produce the quantity of gas from a ton of coal that is now considered fair and reasonable carbonization—a quantity that 25 years ago was thought impossible. It would be misleading to mention any quantity as a guide for what is considered fair carbonizing, for the quantity of gas which might easily be produced from one class of coals, it would be impossible to obtain from coal of another description; but it may be considered as a general rule that we now take about 2,500 cubic feet of gas more from a ton of coal than was thought possible 25 years ago. Though we have made many improvements in the carbonizing department, much more remains to be done. The constant demand is for cheap gas, and if gas is to be sold at a less price, it must be produced at a less price; how is this to be done? We cannot take much more from a ton of coal than is now taken in all well-arranged works, and we cannot reasonably expect our stokers to carbonize more coal per man than they are now doing. The stokers are, as a rule, I believe, fairly paid for their labor, yet you will all admit that their work is not pleasant, neither is it easy, but taxes their physical powers to their utmost extent. The question then crops up, how can the retort house labor be cheapened? Or, in other words, how can we reduce the cost of the labor required to produce 1,000 feet of gas? In thinking of this, our mind naturally turns to the mechanical engineer with the inquiry, can he assist us? Some of you will say, "Yes, he can and has done so;" others will say that the mechanical assistance has yet to come. Machinery for stoking purposes is not a new idea, but has employed the mind at some time or other of almost all gas engineers who have a gift for mechanics. There have been many inventions, from the time of Clegg's revolving wet retort, to the stoking apparatus of the present day, but very few of them have ever been used except in works under the management of the

inventor, and we have generally found, after a short trial, that they have fallen into disuse. As far as I am aware, there are only two or three stoking apparatus that have been tried in works, not under the management of the inventor, that have given satisfaction, and have continued in use after the first few months' trial; and the one that seems to be the most successful is the invention of our brother member, Mr. West. I shall be pleased if one of our members who is using the apparatus will give us a paper on this subject at an early date.

"The fault of most I may say all stoking machines appears to be that they all require a special setting of retorts. A machine to come into general use must possess the following qualities, viz., it must be easily adjusted to the settings of existing retorts and retort houses, must be simple in its construction, easily managed, require but little motive power, and must not be expensive. Any inventor who can produce such a machine will ensure the recommendation of gas engineers and managers, and receive their thanks and blessings, especially on Bank Holidays and Saint Mondays.

"We often hear the expression used, "You cannot take more out of a ton of coal than there is in it." This is, of course, quite true, but something else follows. When you have carbonized a ton of coal, has it been done in the best manner? Have you sent the solid matter to the coke heap or to the breeze heap? Have you sent the distilled matter to the tar tank or to the gasholder? This at once would open the question of high heats versus low heats, but I am not going into the question to-day, for, like the dispute in the Vicar of Wakefield, much may be said on both sides. My object in mentioning this is to draw your attention to another question, viz., the depth of the layer of coal in the retorts. This is a subject which should receive more attention than is generally given to it.

"Some 15 years ago I conducted a series of experiments in this direction. The coal used was Pelaw Main. The layers were varied from one inch to 11 inches in thickness, and the time the coal laid in the retorts varied from one hour to eight hours. The best results, both for quantity, quality and purity of the gas produced, were obtained from the thin layers and quick charges, but the extra cost of labor required considerably more than counteracted the advantage gained by the increased quantity of gas produced.

"The advantage of a simple, reliable, and easily worked mechanical stoking apparatus would certainly not be confined to the saving of labor only, for light and quick charges would certainly follow, and an increase in the quantity and quality of the gas produced be the result."

The Montreal Gas Company's Annual Meeting.

The annual meeting of the Montreal gas company took place at the gas works, Ottawa street, on the afternoon of Monday, April 4th. Amongst those present were Mr. Jesse Joseph, President; Mr. J. F. Scriver, Secretary; Drs. Wm. Macdonald and G. W. Campbell, and Messrs. Robert Anderson, Robert Benny, Richard Bolton, W. Barrett, John Crawford, Alex. Clerk, D. J. Craig, W. B. Cumming, Horace Joseph, Henry Lyman, Moncel, John Ostell, Thomas Peck and Alex. Urquhart.

The Secretary read the report, which has been already published.

The President then signified his willingness to answer any questions.

Mr. Bolton asked what had been the waste from condensation and evaporation.

The President replied 20½ per cent., which was an improvement upon previous years, as in 1878 it had been 27 per cent. and in 1879 25 per cent. This improvement had been obtained notwithstanding the many leakages from frost and the breaking of the pipes, and it was due to a new system of discovering leakage, which he described.

Mr. Bolton inquired if there was any increase in the number of consumers.

The President replied that owing to the depression of trade, there was in 1877, '78, and '79 a decrease in the number of meters of something like 200 each year, people giving up gas and taking to coal oil, but during the last year there was an increase of 188 meters.

Mr. Anderson asked if they sold any land last year.

The President said no. They had some under discussion for the convenience of railways, and it would probably sell next year. The profits from the land were very good. There was some land which did not appear in the assets. It consisted of some 600,000 feet in the rear of the works, running nearly to Sherbrooke street. This land was valuable as it was in the neighborhood of two railways, and the prospects were good of selling a good deal for a variety of purposes. There was another piece more valuable still, on the river front bounded by St. Mary street and the railway running along the harbor. The land consisted of 68,000 feet. If that were sold to-morrow there would be an asset the stockholders could do what they liked with, which does not at present appear in the assets at all.

Mr. Crawford asked what was the value of the land at Hochelaga.

The President replied, the minimum value he considered to be 10c. per foot. There were 600,000 feet worth 10c., making $60,000. The front at 75c., would make $51,000, or a total value of from $111,000 to $120,000. If anybody offered that to-morrow it was a question whether they would take it; but it would come in as an asset.

In reply to other stockholders, the President said this was quite independent of the street, and of the land which had been reserved for works. In some large cities such as London and Boston, they had a difficulty in getting room for their works, owing to increase of business, but at Hochelaga they had made ample provision for reserving four or five acres. Their works there would be worth seeing.

Mr. Anderson asked if they had been successful with the gas stoves.

The President replied that they had. But, as with all new things, people wanted to know what their neighbors thought about them. The directors considered that when they sold one stove it would be the means of obtaining other purchasers. There was one drawback. The introduction of any new thing was attended with great expense, and they had been pretty liberal in that way. They had taken care that every consumer of gas should have a circular. They had gone to some expense to make sure they were getting the most improved kind of stove. They had had specimens from England and the United States, and they could say that they had got the very best stove out. They made them in their own establishment, great care and skill being required in the work. All the material was imported from Europe, and they could make them with great economy. They sold them at cost as nearly as possible, the great object being to increase the consumption of gas.

Mr. Crawford asked how many they had put out.

The President replied 180, and they expected to put out 200 more in a short time.

Mr. Crawford suggested the employment of a competent agent to go round and canvas for the sale of them, but the suggestion did not find much favor.

Mr. Crawford asked for information respecting the drainage nuisance, about which they had received a protest.

The President gave a detailed statement of their position towards the corporation, and said they had a private drain; but whilst it was being repaired they obtained permission from the City Surveyor to use the ordinary drain. An outcry was raised, and the thing was at once stopped; that was about four weeks ago. The smell complained of was that of sulphuric acid gas; and he has been told by people capable of forming an opinion that it was healthy.

Mr. Bolton asked what improvement had been made in regard to electric light.

The President gave a detailed statement of its cost and utility, and of how it affected gas stocks in various places, through people being scared. He did not think they had any occasion to fear competition in this direction.

Mr. Lyman also spoke on the subject, and maintained, notwithstanding all statements to the contrary, electric light could not be produced without great expense.

In answer to enquiry, the President read from the American Gas Light Journal the quotations of Manhattan gas company stock—Jan., 165@170; Feb., 182; April, 180.

The retiring directors were re-elected, namely, Messrs. Jesse Joseph, D W. Macdonald, and Dr. G. W. Campbell.

The meeting then adjourned.—Montreal *Gazette*.

An English Opinion on the Dieterich Furnace.

The London *Journal of Gas Lighting*, of March 1st, contains a very complete illustration and description of the appearance and method of application of the Dieterich furnace. It comments editorially upon the same subject in the following manner—

AN AMERICAN FORM OF GENERATOR FURNACE.

Wonderful things are spoken of the Dieterich furnace, as adopted in the gas works of Baltimore, Maryland; and we have pleasure in being able to lay before our readers, in another column, the very complete report on the arrangement furnished by our American correspondent. It will be observed there is a strong family likeness between the Dieterich and some of the German patterns of generators. It cannot be said that the American arrangement for clinkering is of the most improved type—the device of introducing a supplementary grate to sustain the fuel reminds us of Dr. Schilling's early practice. It would seem that a better way to deal with clinker would be to prevent its formation in the first place, in which there is no difficulty. The sand-lute, too, is a somewhat clumsy way of closing the feeding door, and it might be advantageously dispensed with by Mr. Dieterich, as it has been by Herr Hasse and others. It may also be said that many experienced carbonizers, whose word is worthy of regard, are very doubtful as to the great amount of profit sometimes said to be derived from the practice of stoking with hot coke, to which Mr. Dieterich attaches great value; and the point cannot be considered as satisfactorily settled either way. The great heat at which the Dieterich generator is worked seems to suggest that it is almost

as much a direct-acting as a gas-generating furnace, and it is difficult to imagine that no serious loss by radiation is thereby caused. The actual working results appear to be good, although it is hard to understand our correspondent's statement that he suffered no inconvenience when his hand was over the exit of the flues. It of course depends upon the height at which he was placed in reference to the said flues; but this would have been easily found if we knew the absolute temperature marked by a thermometer in the flue itself. The entire communication is, however, of great interest, as showing the important efforts that are now being made in America, as elsewhere, to economize fuel and improve the method of carbonizing coal.

Gas Lighted Buoys

The idea of illuminating floating beacons by means of gas appears at first sight to be rather a visionary one. On looking into the matter, however, we shall find that it is not so, nor even an idea at all now, but an accomplished and a practical fact. It is not, however, effected with ordinary coal gas, nor do the ordinary conditions of consumption obtain. The means by which this end is attained are the same as those which have at length rendered efficient railway-carriage lighting possible, namely, Pintsch's oil gas system. At page 145 of our last volume will be found a full description of this system, and at page 469 are particulars of its most recent application on railways in connection with the London and South-Western system. We need only, therefore, now observe that it consists in distilling the refuse of shale oil, or other similar matter, and in storing and using, under considerable pressure, the gas produced from it. If this storage and use can be successfully accomplished on land—and we need hardly say that it not only can be, but is—it should follow that, other things being equal, there can be no difficulty in storing and using it under similar conditions on water. Nor is there any difficulty in this respect, the system having been carefully developed, step by step, from a clever idea into actual practice. The buoy itself is made the recipient for containing the compressed gas, and the lamp mounted on the top will burn for periods of six, nine or twelve weeks, according to size, with one filling, the diameters being 7 feet, 8 feet, and 9 feet respectively. The buoys are made of wrought iron and of the necessary strength for resisting the internal pressure and the external blows incidental to such objects afloat. The Trinity House has two spherical buoys lighted on Pintsch's system, the gas for which has, up to the present time, been supplied from the Great Eastern Railway gasworks, at Stratford, Pintsch's system being in use on that line for carriage-lighting. Arrangements are, however, being made with a view to the establishment of a small gasworks in connection with the Trinity Board, and it is probable that this plan will shortly be carried out. One of the Trinity House buoys was placed on the East Oaze station, near the Mouse Lightship, on the 18th of April last, and remained at its station until the 28th of last month, when it was unfortunately run into and damaged by a passing vessel. The Trinity House report that during that period the light was burning without intermission, although it is stated by the officer in charge of the Mouse Light vessel (1¾ miles distant) that in bad weather the buoy itself was at times hidden from view by the spray of the sea.

At Port Glasgow, the Clyde Lighthouse trustees are building a gasworks on Pintsch's system, for the service of illuminated buoys on the Clyde. One of these buoys has been burning on the Roseneath Patch for some time past, being supplied with gas from London. A second—a bell buoy—is about to be delivered by Pintsch's Lighting Company, for use on the Clyde. This company is also about to despatch a buoy to Port Said, for the use of the Suez Canal. This buoy we recently had an opportunity of inspecting, and can testify to the excellence of the light given. It will show a red light day and night for six weeks. The buoy is 7 feet in diameter, and has a capacity of 150 cubic feet. The gas will be stored at a pressure of 7 atmospheres, or 105 lbs. per square inch, which give 1050 cubic feet of gas in the compressed condition. The gas being burned at the rate of 7-10ths of a foot per hour renders this supply available for six weeks. The estimated cost of gas per 24 hours' consumption is 2½d., not a very extravagant cost, it will be admitted. The process of refilling a buoy is merely a matter of a few minutes. The gas is taken to the buoy in a tender, and is passed from the reservoir or store tank by means of a flexible tube into the buoy, where it is stored for consumption at the required pressure. By the adoption of gas works on shore, in the vicinity of the buoys, the whole operation is reduced to a very simple system. From the proved efficiency of these buoys, and the special advantages they offer for marking entrances to harbors, river passages, wrecks and the like, there can be but little, if any, doubt of their general adoption for the purposes we have indicated, as well as for others of a cognate character.—*Iron.*

GOLD INK.—Grind gold leaf with honey in a mortar until it is reduced to a fine powder. Wash out the honey with hot water and add mucilage of gum arabic. A cheap article may be made by using yellow bronze powder.

The Electric Light in Mines.

A good deal of discussion has taken place as to the value of the electric light, and how far it could be made available for mining and household purposes. Of late considerable improvements have been made by Mr. Swan, of Newcastle-on Tyne, as well as by other gentlemen, and there is every reason for coming to the conclusion that before long electricity will be found in operation in our mines. The subject has received a good deal of attention from the Royal Commission on Accidents in mines, and from whose report we may expect to find some interesting information with respect to the safest mode for lighting mines. But it will have to be so arranged that there will be some addition made in the shape of an instrument for the detection of explosive gases, which the electric apparatus would not do. Electricity is already used in connection with some mining operations, and at a *conversazione* held some time ago in Sheffield Mr. Apps, of the Strand, exhibited several most interesting electrical appliances that attracted a good deal of attention. One of these was in connection with mining purposes, and was what is termed a magneto-electric exploder, having the appearance of a small box, with a key attached to it. On depressing the latter a current of electricity was at once generated that would explode one of Abel's fuses, and so igniting any explosive it was connected with. The lighting of the ordinary fuse in our mines in some instances has led to serious consequences.

In some cases accidents have occurred whilst forcing a pricker into a hole which had lost fire, a practice which had ought not to be allowed, the safest plan under such circumstances being to make a new hole, and use a fresh charge. But miners, as a rule, prefer adopting any system that will not cause any loss of time, despite the danger they run by so doing; but by the adoption of electricity in exploding fuses all necessary safety would be ensured, and at a comparatively trifling cost. Lighting the working places in mines by electricity does not appear to be attended with so much difficulty as many persons appear to think would be the case. It would be of the greatest possible advantage, for by it an explosive mixture could not be ignited, as is now the case with many so-called safety lamps, whilst the light would be such as to enable the miner to get a much larger quantity of mineral in a given time, and with less labor than he is obliged to give now. If the electric light can be arranged for domestic use, of which there appears now to be no doubt, then there cannot be any insuperable reason why it should not be made to do duty in our mines in a similar manner as in a room.

At the gathering at Sheffield to which we have alluded it was demonstrated that the electric light could be easily adopted for domestic purposes. Mr. J. W. Swan, the President of the Newcastle Chemical Society, exhibited a pair of his improved incandescent electric lamps for household use. The apparatus was most simple in appearance, consisting of a pear-shaped bulb of glass, attached to it being what would be taken for a wire, but was composed of carbon, prepared by charring cardboad or similar material. On being put in action a current of electricity of considerable intensity passed through the loop of carbon, rendering it incandescent, giving a pure white light, admirably adapted for showing the minutest objects, far in excess of what could be obtained from the most brilliant gas light. The completeness of the apparatus depends a good deal on the thoroughness with which the bulb of glass is exhausted of the air, so that the greatest care has to be taken in obtaining the vacuum as complete as possible. These lamps, it is said, must come into pretty general use in the course of time, the question just now, we believe, being more one of cost than anything else. Such being the case, we cannot see why it should not be as successfully applied in the working of mines, where a good light is so much required for those engaged in delving for coal and other minerals.

Mr. Swan's lamp is undoubtedly the best development of the electric light for household purposes that has yet been brought before the public, and we do not expect that he will be satisfied with the success that he has already achieved when there is such an interesting problem as yet not quite solved—the lighting of mines by electricity.

How far the experiments of the scientific members of the Royal Commission for the Prevention of Accidents in Mines have gone in showing whether the electric light can be adopted for mining purposes remains to be seen, so that we shall look forward to their report with no common interest. In the meantime, however, a good deal may be expected from the researches of private individuals like Mr. Swan with respect to a subject of so much importance to the interests of the country, as well as to the safety of a large body of working men connected with our greatest industries, and which have made us the wealthiest nation in the world.—London *Mining Journal.*

CONSOLIDATION.—The Newburgh Gas Light Company, of Newburgh, New York, and the Consumers Gas Light Company, of the same place, have been consolidated under the name of the Consumers Gas Company.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS Co., 39 and 41 Chambers St.
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 22 Buckingham St., London, W. C.
Germany—B. WESTERMANN & Co., of New York

SATURDAY, APRIL 16, 1881.

Steam Heating at Troy, N. Y.

The Citizens Steam Heating Company, of Troy, New York, has been organized with a paid up capital of $40,000, which it is proposed to increase to $75,000 in the near future.

The following gentlemen are named as the incorporators: Andrew M. Church, Geo. B. Smith, Frederick A. Sabbaton, John T. Christie, Jas. Kelly and Lamott W. Rhodes.

Telephones in India.

The Government Telegraphs Department in Calcutta obtained in November last, a sample supply of some thirty of the loud-speaking telephones of the Gower-Bell Company for experimental trials, and it is reported that the results have given so much satisfaction that the company has now received by telegraph an order for a large number of its instruments.—*Jour. Soc. Arts.*

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W R Scott & Co.,)
34 PINE STREET, NEW YORK CITY.
APRIL 16, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.

	Capital.	Par.	Bid.	Asked
Central	$466,000	50	60	65
Harlem	1,800,000	50	65	70
" Bonds	170,000			103
Manhattan	4,000,000	50	180	182
Metropolitan	2,500,000	100	135	140
" Scrip	1,000,000	..	102	103x
Mutual	5,000,000	100	70	72
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	155	160
" Bonds	750,000		106	110
New York	4,000,000	100	97	101
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	45	50
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	55	60
Peoples	1,000,000	10	25	30
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	55	60
Nassau	1,000,000	25	45	48
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	60	64
" Bonds		...	98	103
Kings Co	135,000	100	55	60
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			71	72
Bonds			107	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	140	150
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	95	100
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	30	32
Rondout & Kingston			75	80
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			69	70
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	130	200
" Scrip	500,000	20	150	160

The following gas securities were sold at auction: Three shares Metropolitan, Brooklyn, at 56; $6350 Nassau scrip, at 92; $3540 Metropolitan, New York, scrip, at 102¼; 50 shares Manhattan, at 176⅓; 56 shares Harlem at 68; 40 shares New York gas company, at 97.

Advertisers Index.

Page

GAS ENGINEERS.
William Farmer, New York City ... 166
G. Warren Dresser, New York City ... 185

GAS WORKS APPARATUS AND CONSTRUCTION.
Herring & Floyd, New York City ... 187
T. F. Rowland, Greenpoint, L. I. ... 187
Deily & Fowler, Phila., Pa ... 187
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 187
Stacey Mfg. Co., Cincinnati, Ohio ... 187
Bartlett, Hayward & Co., Baltimore, Md ... 187
P. Munzinger, Phila., Pa ... 187
Brown & Owen, Phila., Pa ... 187
Morris, Tasker & Co., Limited, Phila., Pa ... 187

GAS AND WATER PIPES.
A. H. McNeal, Burlington, N. J ... 186
Gloucester Iron Works, Phila., Pa ... 186
R. A. Brick, New York City ... 189
James Marshall & Co., Pittsburgh, Pa ... 186
R. D. Wood & Co., Phila., Pa ... 185
Warren Foundry and Machine Co., Phillipsburgh, N. J ... 186
Mellert Foundry and Machine Co., Reading, Pa ... 186

WASHERS AND SCRUBBERS.
A. C. Wood, Syracuse, N. Y ... 183
G. Shepard Page, New York City ... 158

RETORTS AND FIRE BRICK.
J. B. Gautier & Co., Jersey City, N. J ... 184
B. Kreischer & Sons, New York City ... 184
Adam Weber, New York City ... 184
Laclede Fire Brick Works, St. Louis, Mo ... 184
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 184
Borgner & O'Brien, Phila., Pa ... 184
Gardner Brothers, Pittsburgh, Pa ... 184
Henry Maurer, New York City ... 184

DIETERICH'S REGENERATOR FURNACE.
Charles F. Dieterich, Baltimore, Md ... 190

GAS METERS.
Harris, Griffin & Co., Phila., Pa ... 190
American Meter Co., New York and Philadelphia ... 191
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 191
Helme & McIlhenny, Phila., Pa ... 191

GAS STOVES.
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 168

VALVES.
Ludlow Valve Manufacturing Co., Troy, N. Y ... 184
Chapman Valve Manufacturing Company, Boston, Mass ... 184

EXHAUSTERS.
P. H. & F. M. Roots, Connersville, Ind ... 185
Smith & Sayre Manufacturing Co., New York City ... 185

GAS COALS.
Penn Gas Coal Co., Phila., Pa ... 189
Perkins & Co., New York City ... 188 189
Cannelton Coal Co., New York and Philadelphia ... 189
New York and Cleveland Gas Coal Co., Pittsburgh, Pa ... 189
Newburgh Orrel Coal Co., Baltimore, Md ... 189
Despard Coal Co., Baltimore, Md ... 189
Tyrconnell Coal Co., Baltimore, Md ... 188
Fort Pitt Gas Coal, Pittsburgh, Pa ... 189
West Fairmont and Marion Coal Co., New York City ... 188
Montauk Gas Coal Co., New York City ... 189
Chesapeake and Ohio R.R Coal Agency, N. Y. City ... 188

GAS ENGINES.
Schleicher, Schumm & Co., Phila., Pa ... 183

STEAM STOKERS.
A. Q. Ross, Cincinnati, Ohio ... 192

STEAM ENGINES.
F. C. & A. E. Rowland, New Haven, Conn ... 182

PURIFIER SCREENS.
George D. Cabot, Lawrence, Mass ... 191

BURNERS.
G. Gefrorer, Phila., Pa ... 184

STREET LAMPS.
S. G. Miner, New York City ... 182

PURIFYING MATERIAL.
Connelly & Co., New York City ... 182

STEAM BLOWER FOR BURNING BREESE.
H. E. Parson, New York City ... 182

PROCESSES.
Gwynne Harris New York City ... 186

EDGE'S PROCESS. REMOVING CARBON
D. D. Flemming, Jersey City, N J ... 182

GAS FIXTURES.
Mitchell, Vance & Co., New York City ... 185

CEMENT.
S. L. Merchant, New York City ... 185
F. O. Norton, New York City ... 185

BOOKS.
Economy of Gas as a Fuel ... 188
Journal des Usines a Gaz ... 92
Gas Analyst's Manual ... 92
Scientific Books ... 186
Cathels' Gas Consumers' Manual ... 191
Fodell's Book-Keeping ... 191
Review of Gas and Water Engineering ... 167

Situation Wanted

A man of twenty years' experience desires a situation as
SUPERINTENDENT OF SMALL GAS WORKS
Address AMERICAN METER COMPANY,
394-3t Arch and 22d Sts., Phila., Pa.

Tyson Vase Engine.

FOR DRIVING SEWING MACHINES, DENTAL LATHES, SCROLL SAWS, ETC.

Absolutely non-explosive under all circumstances and conditions. Cylinder, 1¼ inch bore, 2½ stroke. Weight, 60 lbs; height, 41 inches; power, 1,000 foot-pounds (1-33 horse power); fuel, 12 ft. of gas per hour. We now provide these engines with a governor, and an arrangement which (being attached by a cord to the treadle wheel of an ordinary sewing machine) gives the operator entire control of the starting, stopping, and speed of the sewing machine, by pressure upon the treadle. Price, $50.

See *Scientific American* of March 13, 1880.

TYSON ENGINE CO.,
1301 Buttonwood St., Phila., Pa.

FOR SALE,

Three Benches of Fives; Six-inch Stand and Bridge Pipes, with Farmer's Dip-Pipe Valves; Twenty-four inch Main; Morris & Tasker's Self-sealing Lids; One Mackenzie Exhauster, Six-inch Connections.

For further information apply to

CONSUMERS' GAS COMPANY,
334-tf **NEWBURGH, N. Y.**

WANTED,

SUPERINTENDENT OF GAS WORKS,

FOR TEXAS TOWN OF 15,000 POPULATION.

Must be middle-aged and of practical experience. References required Address
334-1t "PRESIDENT," Care this Office.

WANTED,

A Situation as Foreman or Otherwise,

By a practical gas-maker, experienced in making coal gas and carburetted water gas, etc., and is a thorough mechanic at inside and outside work. Can give the best of references. Address
334-1t "J. C.," 327 South 4th St., Brooklyn, E. D.

ENGAGEMENT DESIRED

AS SUPERINTENDENT OF GAS WORKS.

Has had 15 years' experience; thoroughly understands the business in all its departments—the construction of gas works, manufacture of gas, laying of street mains, inspection of gas fittings, or is a practical gas fitter. Can make own drawings of works, and thoroughly understands and can perform the secretary duties of the office. Can give the highest references if necessary.
333-3t Address "SUPERINTENDENT," Care this Journal.

TO GAS COMPANIES IN THE UNITED STATES

Purification of Coal Gas.

PATTERSON'S PROCESSES of purifying Coal Gas from the residual Sulphur, commonly called "sulphur compounds in other form than sulphuretted hydrogen," have been acknowledged by all the most eminent Gas Chemists and Gas Managers of the United Kingdom to be the only known and perfectly efficacious processes for extracting this most objectionable and hitherto irremovable impurity from Coal Gas; and the entire cost of the Processes is far more than compensated by the gain in illuminating power ensuing from the perfect extraction of the Carbonic Acid.

Extraction of the Carbonic Acid *per se* is a simple and long-known process; but by no processes except Patterson's can this extraction of the CO_2 be effected *together with the extraction of the Sulphur.*

Patterson's Processes greatly facilitate the avoidance of Nuisance, and also the Revivification of the fouled purifying materials.

These valuable Inventions are secured throughout the United States of America by the Patent granted to Mr. Patterson on the 8th of April, 1873, No. 137,713.

Royalties will be granted throughout the United States at the very low rate of £100 a year for the largest gas works, and less for smaller works.

Mr. Patterson also gives advice in all branches of Gas Purification, at fees ranging from £10 upward. Communications and applications to be addressed

"PATTERSON'S PATENTS,"
Office of this Journal.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 42 PINE ST., N. Y.

SITUATION WANTED

AS MANAGER OF A GAS WORKS.

Has had twenty years' experience in the erection and management of the same. Address T. T. TASKER,
324-4t Delaware Iron Company, New Castle, Del.

ROWLAND'S Vertical Engine.

COMBINING EFFICIENCY & DURABILITY.

BEST ELECTRIC LIGHT ENGINE.

Piston and Crank Shaft of Steel.
Broad bearings. Very simple.

F. C. & A. E. ROWLAND, New Haven, Ct.

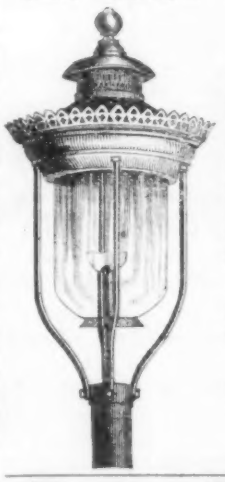
THE PROCESS FOR REMOVING THE Carbonaceous Incrustations FROM THE INTERIOR SURFACE OF CLAY RETORTS,

PATENTED BY THE LATE GEORGE W. EDGE.

The subscriber, having secured the title to the *above patent,* is prepared to negotiate with gas companies for its use on very reasonable terms. The great economy of this process has been thoroughly demonstrated in this country and in England, and is the only method so far discovered that removes this troublesome accumulation expeditiously and without injury to the retorts. Address

D. D. FLEMMING, Jersey City Gas Works,
JERSEY CITY, N. J.

THE GLOBE STREET LAMP.



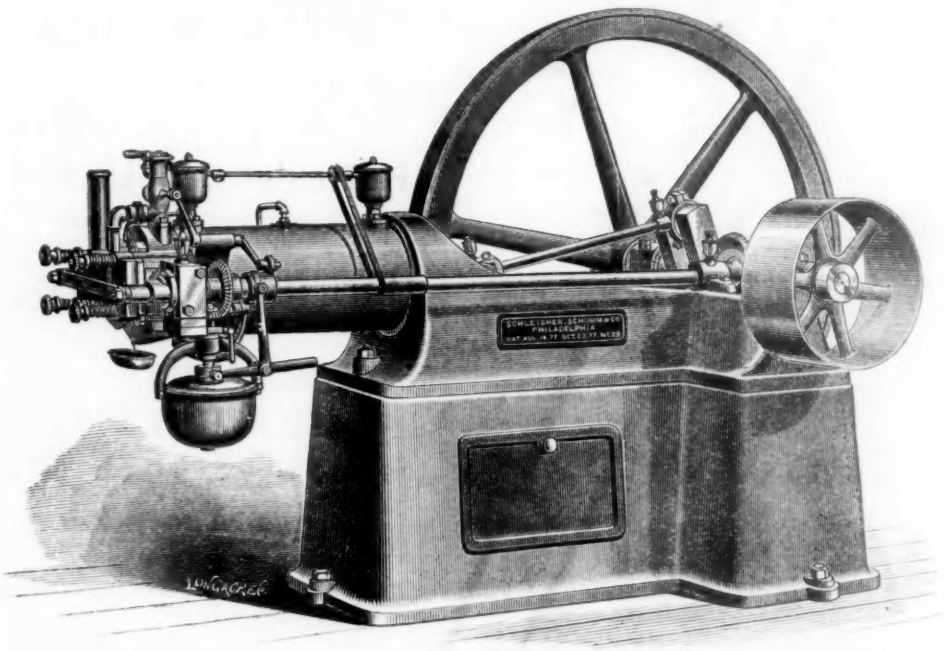
J. G. MINER.
Morrisania, N. Y. City.
SOLE MANUFACTURER OF
Miner's Pat. Street Lamps, with Fixtures for Hanging and Bracket Lamps. Also, Miner's Improved Lamp Posts.

Iron Sponge AND GAS EXHAUSTERS.

CONNELLY & CO.,
No. 407 BROADWAY, NEW YORK CITY

SILENT GAS ENGINE.

Always Ready to be Started, and to give at once Full Power.



NO STEAM TO MAKE OR MAINTAIN.

NO COAL NO ASHES NO DIRT

NO FIRE NO DANGER NO EXTRA INSURANCE

NO GAUGES, NO PUMPS NO LEAKAGE

ALMOST NO ATTENDANCE.

BURNS COMMON GAS.

AVERAGE CONSUMPTION PER HORSE POWER

21 1-2 Cubic Ft. Per Hour.

COSTS NOTHING WHILE STANDING LITTL WHIL RUNNING WITHOUT DOING WORK AND WHILE WORKING THE GAS IS PRECISELY REGULATED BY THE GOVERNOR IN PROPORTION TO THE POWE DEVELOPED

SIZES AT PRESENT OFFERED, **2, 4 and 7 H. P**

LARGER SIZES TO ORDER.

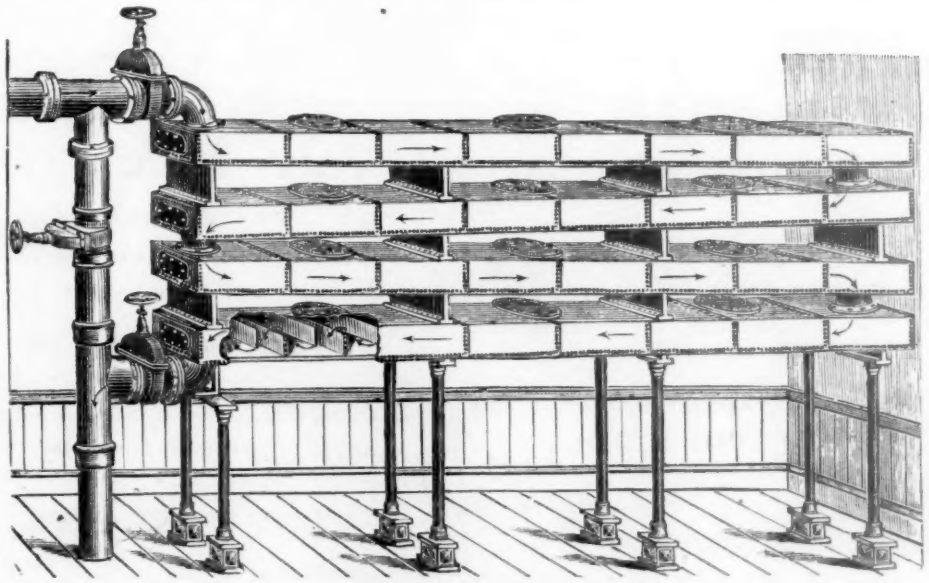
THE NEW OTTO SILENT GAS ENGINE.

Unexcelled for Convenience and Economy in running Gas Exhausters, Tar and Ammonia Pumps, Hoists in Warehouses or Stores, Ventilating Theatres, Halls and Buildings, Driving Electro-Magnetic Machines,

And useful generally for all work of small stationary steam engines. Where work is intermittent, trouble with a steam boiler and engine is at its maximum, but is at its minimum with a gas engine. For particulars, prices, etc., apply to

SCHLEICHER, SCHUMM & CO.,
3045 Chestnut Street, Philadelphia.

A. C. WOOD'S DRY SCRUBBER.



This Scrubber has been in use for three years, and found to be the cheapest, simplest, and most effective Scrubber for removing tar and ammonia from the gas ever brought to the notice of gas manufacturers.

IT LEAVES NO TRACE OF AMNONIA.

No expense for coke, wood, or other material. No danger of stoppages, no cleaning out to be done. There is no increase of pressure, the gas having a full, free passage of equal capacity of the connecting pipes.

Made in size to suit the capacity of any works.

See pages 150 and 151 of the "American Gas Light Journal" of April 2, 1879. For estimates of cost, address,

A. C. WOOD, SYRACUSE, N. Y.,

Or the Builders, T. F. ROWLAND, Greenpoint, Brooklyn, N. Y.; DAVIS & FARNUM MFG. CO., Waltham, Mass.

A. C. WOOD'S CAST IRON PIPE CUTTER

Continues to be used by Gas and Water Companies in various parts of the country with the most satisfactory results. It cuts cast or wrought iron pipe of any size, from three inches to the largest made, leaving the edges clean, smooth, and true. Address, **A. C. WOOD, Syracuse, N. Y.**

J. H. CAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER.
393-1y C. E. GREGORY

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE
FIRE BRICKS AND
GAS RETORT WORKS
CHELTENHAM, MO.
Hand and Machine made Retorts and Settings, Superior Fire Bricks for Siemans Gas and Glass Furnace. Bricks and Tiles for Whitwell's Hot Blast Ovens, Blast Furnace and Cupola Tiles, Etc.
Fire Bricks and Tiles
of all shapes and sizes.
Glass Pot Clay. Fine Ground Clay and Fire Bricks. Sewer Pipe, Etc.
901 Pine Street, St. Louis, Mo.
642—

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

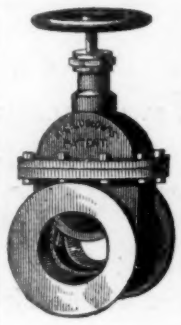
Borgner & O'Brien,
MANUFACTURERS OF
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.
23d St., Above Race,
PHILADELPHIA.
TWENTY YEARS' PRACTICAL EXPERIENCE.

Works, LOCKPORT, PA.
GARDNER BROTHERS,
—ESTABLISHED 1864.—
Works, MT. SAVAGE JUNCTION, MD.
CLAY GAS RETORTS, RETORT SETTINGS, FIRE BRICK, TILES, Etc.
MINERS & SHIPPERS OF FIRE CLAY. OFFICE, 116 SMITHFIELD ST., PITTSBURGH, PA.
C. H. SPRAGUE, No. 13 EXCHANGE PLACE, BOSTON, MASS., Agent for the New England States.

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERS
HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

CHAPMAN
VALVE MANUFACTURING COMPANY,
MANUFACTURERS OF
Steam, Gas, and Water Valves and Gates.
FIRE HYDRANTS,
WITH POSITIVE DRIP.
All Valves and Hydrants furnished with
Babbitt Metal Seats & Non-Corrosive Working Parts.
WORKS AT INDIAN ORCHARD, MASS.
Boston Office, 77 Kilby St. New York Office, 28 Platt St.
ALL WORK GUARANTEED.

LUDLOW
Valve Manf'g Co.,
OFFICE AND WORKS
938 to 954 River Street and 67 to 83 Vail Ave
TROY, NEW YORK.
BRASS AND IRON SLIDE VALVES
(Double and Single Gate ½ inc to 36 inch—outside at inside screw Indicator etc fo Gas Wate and Steam
HYDRAULIC MAIN DIP REGULATORS.
ALSO
FIRE HYDRANTS.

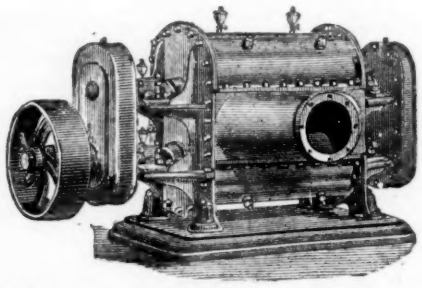


REFERENCES FURNISHED.
SEND FOR CIRCULARS.

C. CEFRORER.
Manufacturer of
GAS BURNERS,
GAS HEATING AND COOF ING APPARATUS.
FITTERS' PROVING APPARATUS, ETC.
No. 248 North Eighth Street, Philadelphia.

KING'S TREATISE
ON
COAL GAS.
Vol. I., Bound in Cloth, $10
A. M. CALLENDER & CO., 42 Pine Street, N. Y.

P. H. & F. M. Roots'



IMPROVED GAS EXHAUSTER

With Engine on same Bed Plate, or without.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, &C., FURNISHED TO ORDER.

P. H. & F. M. ROOTS, Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 6 Cortland St. and 8 Dey St., N. Y.
JAS. BEGGS & CO., Selling Agents, 8 Dey St., N. Y.
WM. COOKE, Selling Agent, 6 Cortland St., N. Y.

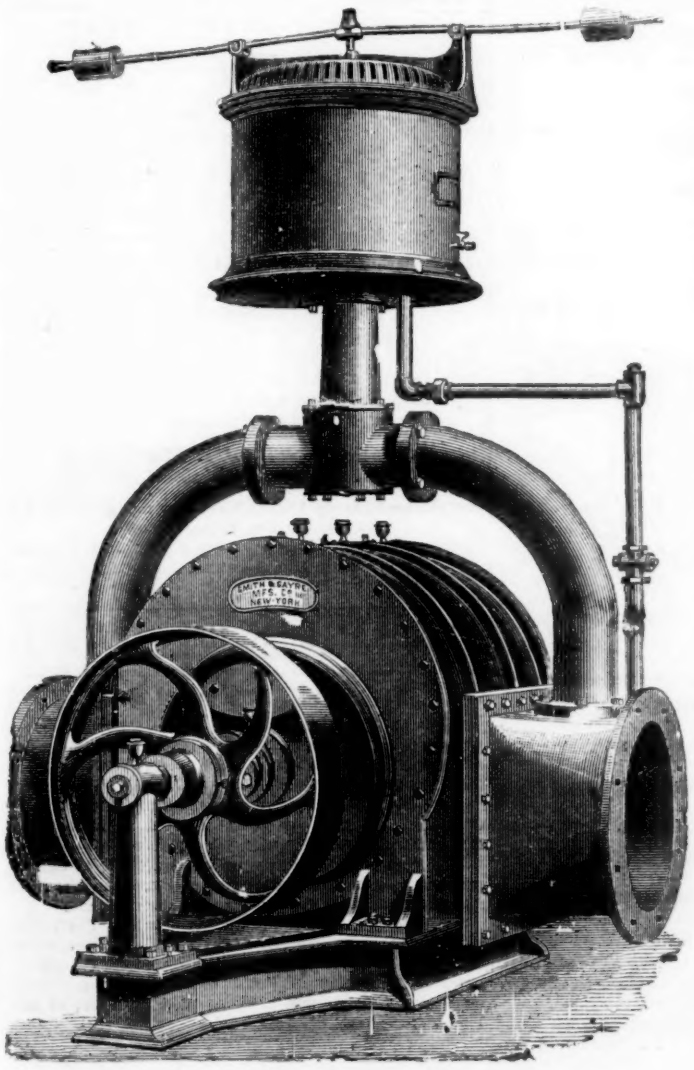
Send for Illustrated Catalogue and Price List

SMITH & SAYRE MANUFACTURING COMPANY.

Coal and Iron Exchange, 21 Cortlandt Street, N. Y

BUILDERS OF

Machinery and Apparatus for Gas Works.



MACKENZIE'S PATENT ROTARY AND STEAM JET GAS EXHAUSTERS, GOVERNORS, COMPENSATORS, BY-PASSES, CONDENSERS, WASHERS, SCRUBBERS.

ISBELL'S PAT. AUTOMATIC STREET PRESSURE GOVERNOR.

HIGH SERVICE GOVERNOR, GAS AND WATER VALVES, HYDRAULIC MAIN DIP REGULATOR, BENCH CASTINGS, Etc. PURIFYING BOXES, TOWER SCRUBBERS, WITH AUTOMATIC WATER DISTRIBUTOR. *ISBELL'S PATENT SELF-SEALING RETORT DOORS.*

Plans and Estimates for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

G. G. PORTER, *President* CHARLES W. ISBELL, *Secretary.*

MITCHELL, VANCE & CO.

Manufacturers of

CHANDELIERS

And Every Description of

GAS FIXTURES,

Also Manufacturers of

Fine Gilt Bronze and Marble Clocks, warranted best Time keepers Mantle Ornaments, &c.

Salesroom, 836 BROADWAY.

NEW YORK.

Special designs furnished for Gas Fixtures for Churche Public Halls, Lodges. &c.

Portland Cement,
Roman Cement,
Keene's Cement
Sellars Gas Cement.

English Fire Brick, No. 1.
" Silica Fire Brick.

IMPORTER

S. L. MERCHANT

41 Broadway, New York,
Just below Trinity Church. 344-1y

Remit 35 cents in postage stamps for new Treatise on Portland and Roman Cement, showing how to mix it and how to use it.

F. O. NORTON,

MANUFACTURER OF

Hydraulic Cement.

Specially adapted for gas works. Under water it is cap a of giving better results than Portland or any other cemen

21 Cortland Street, New York.

G. W. DRESSER, C.E.,

Member American Society Civil Engineers.

CONSULTING ENGINEER

ON ALL MATTERS PERTAINING TO

Gas Manufacture

AND THE UTILIZATION OF

RESIDUAL PRODUCTS.

"How to Burn Gas."

Under this title a neat little book has been issued containing the paper of Mr. Jas. Somerville, as read at the last meeting at Cincinnati, together with a table, taken from Prof. Chandler's lecture, showing the loss of light resulting from the use of shades, etc., of different kinds of glass.

The book is intended for sale to Gas Companies to distribute gratuitously among consumers. If Gas Companies can induce their consumers to use better burners and shades, one-half of the fault-finding will cease.

The price is $10 per thousand. Orders may be sent to the office of this Journal.

Preserve the Journal!

We will furnish to our subscribers an important article for *preserving in a convenient form*, the numbers of the Journal as it is issued at the very low price of $1.25. Sent either by Express or Mail, as directed.

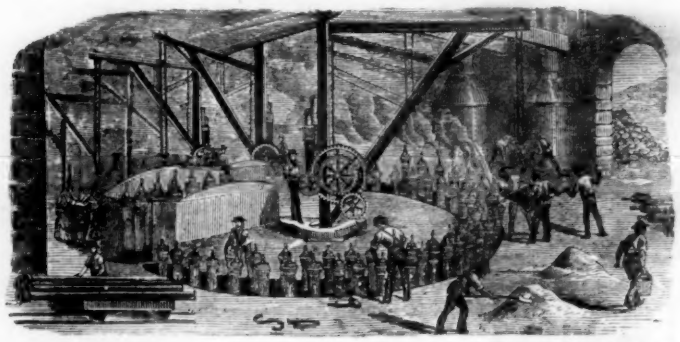
By mail the postage will be 20 cents, which will be added to the price of the Binder. Send orders to

A. M. CALLENDER & CO.
42 Pine Street, Room 18 New York.

A. H. M'NEAL,

BURLINGTON. N. J,

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

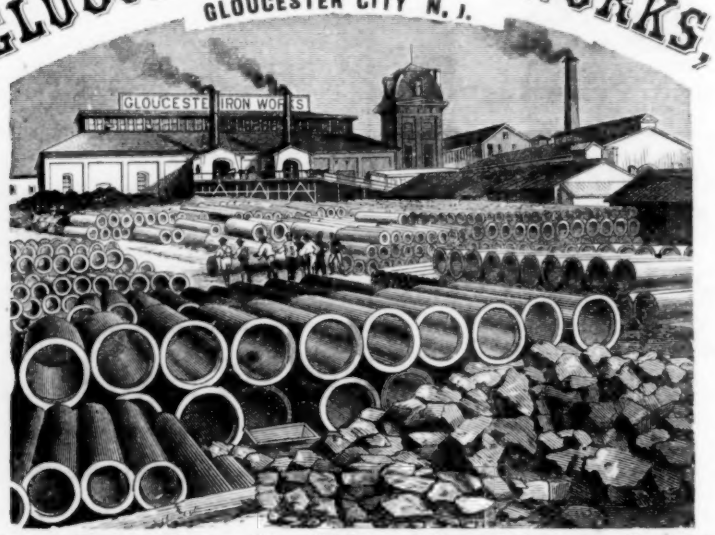
FOR WATER AND GAS.

DAVID S. BROWN, Pres.
BENJAMIN CHEW, Treas

JAS. P. MICHAELSON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY N. J.



Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.
NEW YORK OFFICE, 153 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 436-1

SCIENTIFIC BOOKS.

We are prepared to furnish to GAS MANAGERS and others interested in the topics treated of, the following Books, at prices named :

GAS MANUFACTURE, by WILLIAM RICHARDS, 4 to, with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W HARTLEY. $2.50.

ANALYSIS, TECHNICAL VALUATION, PURIFICATION and USE OF COAL GAS, by Rev. W. R. BOWDITCH, M. A., with Engravings. 8 vo., Cloth. $4.50.

EWBIGGING'S HANDBOOK, by THOMAS NEWBIGGING, C. E. $3.75.

GAS CONSUMERS HAND BOOK, by WM. RICHARDS. C. E. 18 mo. Sewed. 20 Cents.

GAS CONSUMERS MANUAL, by E. S. CATHELS, C.E. 10 Cents.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

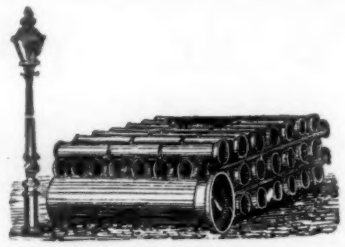
AIR AS FUEL, OR PETROLEUM AND OTHER MINERAL OILS UTILIZED BY CARBURETTING AIR, by OWEN C. D. ROSS, Member Institute Civil Engineers. 8 vo. Cloth. $1.50.

FODELL'S SYSTEM OF BOOKKEEPING FOR GAS COMPANIES. $5.

The above will be forwarded by Express, upon receipt of price.

We will take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances must be made by Check, Draft, or Post Office Money Order.

A. M. CALLENDER & CO.,
Room 10, No. 42 Pine St., N. Y.



R. D. WOOD & CO.,

PHILADELPHIA.
MANUFACTURERS OF

CAST IRON PIPE

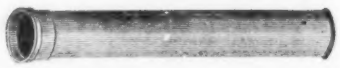
FOR GAS AND WATER
Lamp Posts, Valves, Etc.
Mathew's Pat. Anti-Freezing Hydrants,
400 Chestnut Street.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES



Works, 18th, 19th, 20th and Railroad Stree
Office, No. 23 Nineteenth Street.
Pittsburgh, Pa.

N.B.—Pipes from 3-inch and upwards cast in 12 ft. lengths.
☞ Send for Circular and Price List.

BERGEN IRON WORKS.

R. A. BRICK,

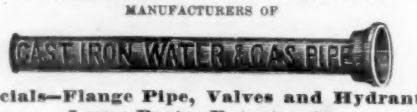
MANUFACTURER OF

CAST IRON PIPES,

FOR WATER AND GAS,
Valves, Fire and Dock Hydrants,
Lamp-Posts and Flange Work,
WILLIAM W. CAMPBELL, Selling Agent,
Office, 85 Liberty St., N. Y.

Mellert Foundry & Machine Co.,

Limited. Established 1848.
MANUFACTURERS OF



Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.
Machinery and castings for Furnaces, Rolling Mills, Grist and Saw Mills, Mining Pumps, Hoists, etc.
ARNOLD MELLERT, Supt., READING, PA.

NATIONAL COAL GAS COMPANY.

320 Broadway, N. Y., Rooms 50, 51 & 52.

H. P. ALLEN, President.

The process known as GWYNNE-HARRIS but from later most essential improvements, more appropriately called the ALLEN-HARRIS, or AMERICAN HYDROCARBON process for making "Water Gas," by the decomposition of superheated steam, in fire-clay retorts, set similarly to those in Coal Gas Works, is an established success. More than One Hundred Million cubic feet of gas have been made under this process, and for *permanency* and *brilliancy*, as well as economy both to the manufacturer and consumer, it is superior to any gas made by the old, or any other method.

Our process is *not intermittent* but continuous. The steam and the oil are admitted into the retorts by gauge cocks, and run for days without change. All the materials required besides the steam, are 17 lbs. of Anthracite coal and about 9¼ gallons of Petroleum or Naphtha, per 1000 feet of brilliant gas.

Rights for sale. Inquire of the President.

HERRING & FLOYD,

Oregon Iron Works,

738, 740, 742 & 744 Greenwich St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS

AND

APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS; MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS
(wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
of all sizes and description.

FLOYD'S PATENT
MALLEABLE RETORT LID.

PATENT
SELF-SEALING RETORT LIDS.

FARMER'S
PATENT BYE-PASS DIP-PIPE.

SABBATON'S PATENT
FURNACE DOOR AND FRAME.

BUTLER'S
COKE SCREENING SHOVELS.

GAS GOVERNORS,
and everything connected with well regulated Gas Works at low price, and in complete order.

SELLER'S CEMENT
for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.

Plans, Specifications, and Estimates furnished.

SILAS C. HERRING. JAMES R. FLOYD.

H. RANSHAW, Pres. & Mangr. T. H. BIRCH, Asst. Mangr.
WM. STACEY, Vice-Pres. R. J. TARVIN, Sec. & Treas.

STACEY MANUFACTURING CO.,

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39

Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

Cincinnati Gas-Light Co.	Baton Rouge, La., Gas Co.
Indianapolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co.
Topeka, Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
Burlington, Iowa, Gas Co.	Vicksburg, Miss., Gas Co
Nashville, Tenn., Gas Co.	Denver City, Col., Gas Co.

R. T. Coverdale, Eng'r Cincinnati, and others

MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA, PA.

1842. DEILY & FOWLER 1881

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET, PHILA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. We have built 12 gas works and 135 gasholders. Personal supervision given to the erection of all our work. Holders built at following places since 1868:

Lancaster, Pa. (2)	Indianapolis, Ind.
Williamsport, Pa. (3)	Jacksonville, Ill.
Bristol, Pa. (2)	Joliet, Ill.
Catasauqua, Pa.	Lawrence, Kansas.
Kittanning, Pa.	Jefferson City, N. O. La. (2)
Hazelton, Pa.	Algiers, N. O., La.
Freeport. Pa.	Kalamazoo, Mich
Huntingdon, Pa.	Buffalo, N. Y. (2)
Pittston Pa.	Ogdensburg, N. Y
Bethlehem (S). Pa.	Waverly, N. Y.
Sharon, Pa.	Little Falls, N. Y.
Canton, Pa.	Penn Yann, N. Y.
Carlisle, Pa.	Watkins, N. Y.
Beaver Falls, Pa.	Coney Island, N. Y.
Annapolis, Md. (2)	Batavia, N. Y.
Parkersburg, W. Va.	Gloucester, N. J.
Lynchburg, Va.	Salem, N. J.
Stanton, Va.	Milwaukee, Wis.
Youngstown, O	Burlington, Vt.
Steubenville, O.	Hoosick Falls, N. Y.
Zanesville, O.	Attica, N. Y.
Mansfield, O.	Mount Holly, N. J.
Marion, O.	Mount Joy, Pa.
Bellealre, O.	Rockaway Beach, L. I. (2)
Athens. O.	Zanesville, O. (2)
Barnesville, O.	Lancaster, O.
Newark, O.	Blackwell's Island, N. Y.
Columbus, O.	Waltham, Mass.
Franklin, Ind.	Dorchester, Mass.
Plainfield, N. J.	Wheeling, W Va.
Englewood, N. J.	Lansing, Mich.
Flemington, N. J. (3)	Flint, Mich.
Dover, Del.	Milton, Pa,
Pittsfield, Mass.	Galveston, Texas.
Meriden, Conn.	

BROWN & OWEN,

MANUFACTURERS OF

EVERY DESCRIPTION OF

Gas and Water Works Supplies.

Particular attention given to the alteration of old works. Estimates and Drawings furnished.

THOS. R. BROWN, **R. PITT OWEN.**
Late Chief-Eng. Phila. Gas Works.

Address all communications to

N. W. Cor. 12th and Noble Streets,
482-1y **PHILADELPHIA.**

The Kerr Murray Mfg. Co.,

THE LATEST IMPROVED

Gas Apparatus

AND

MACHINERY,

Wrought Iron Roofs and Bench Castings,

SINGLE LIFT AND TELESCOPIC GASHOLDERS.

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.,

ARCHITECTURAL IRON WORKS.

MANUFACTURERS OF

GAS HOLDERS, BENCH CASTINGS, MULTITUBULAR WATER AND AIR CONDENSERS, COMMON AND TOWER SCRUBBERS, ROTARY & STEAM JET EXHAUSTERS, WROUGHT IRON ROOF FRAMES.

MANUFACTURERS OF ALL DESCRIPTIONS OF GAS APPARATUS.

WORKS:

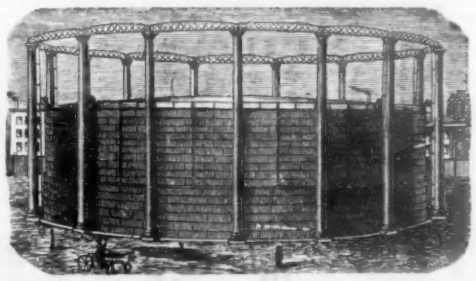
Cors. Pratt, Scott, McHenry, Ramsay and Bartlett Streets.

BALTIMORE, MARYLAND.

Plans, Specifications, and Estimates furnished. Correspondence solicited. 467-1y

---

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,
GREENPOINT, BROOKLYN, N. Y
ENGINEER AND MANUFACTURER OF

GAS-HOLDERS,

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

P. MUNZINGER,

Engineer and Builder,

No. 1211 MARKET STREET, PHILADELPHIA, PENN

BUILDER AND CONSTRUCTOR OF ALL KINDS OF GAS MACHINERY,

ON THE LATEST AND MOST IMPROVED PLAN.

Bench Castings, Condensers, Scrubbers, Purifiers, Centre Valves, Gasholders, Stop Valves, Etc., Etc.

Estimates and Drawings Furnished upon Application.

GAS COALS. GAS COALS. GAS COALS.

"SCOTT'S" OCEAN MINE

YOUGHIOGHENY GAS COAL.

W. L. SCOTT & CO., Proprietors, ERIE, PA.

This Colliery is located at Scott Haven, on the Youghiogheny River, Westmoreland County, Pa., directly adjoining the Penn Company's Youghiogheny Mine.

Over One Hundred and Fifty Thousand Tons of this Coal Sold in 1880

for delivery during the year ending March, 1881, distributed among forty different Gas Company's, including *every Company in New York City, Brooklyn, Jersey City, and Newark*, nearly every Company on the Hudson River as far as Albany and Troy, as well as all the prominent Companies on the Sound—at Boston and other New England ports.

The universal favor with which this coal has been received has induced Messrs. Scott & Co. to increase their already large facilities for meeting the wants of Gas Companies, giving to consumers an undoubted guarantee that delivery will be promptly made. Applications addressed to the undersigned will meet with prompt response.

Orders for delivery in New England can be addressed to our Boston office, No. 21 EXCHANGE PLACE, or P. O. Box 3003, BOSTON.

PERKINS & CO., General Sales Agents,
45 SOUTH STREET, N. Y.

The West Fairmont and Marion Consolidated Coal Company,

Mines at Fairmont, West Virginia,
OFFER FOR SALE THEIR
VERY SUPERIOR GAS COAL,
IN ANY QUANTITY DESIRED, on the shortest notice, at their office, 231 BROADWAY, New York

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE
SUPERIOR KANAWHA GAS COALS,
Also, SPLINT AND STEAM COALS,
From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.
C. B. ORCUTT, SECRETARY. }
J. J. GORDON, SALES AGENT. } **OFFICE, 22 PINE STREET, N. Y.**

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.
Company's Office, 25 S. Gay St., Baltimore.
CHARLES MACKALL, Secretary.
CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.
SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little Ash and scarcely any clinker 04-1y

THE AMERICAN GAS-LIGHT JOURNAL.
$3 PER ANNUM.
42 Pine Street, N. Y.

THE

ECONOMY OF GAS AS A FUEL

FOR

COOKING PURPOSES.

This is a small Pamphlet containing the Paper read by

MR. WILLIAM W GOODWIN, OF PHILADELPHIA, PA.,

At the recent meeting of the American Gas Light Association.

IT IS INTENDED FOR GRATUITOUS DISTRIBUTION BY GAS COMPANIES AMONG THEIR CONSUMERS

Price, Twelve Dollars per Thousand.

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS COALS. GAS COALS. GAS COALS,

NEW YORK AND CLEVELAND
GAS COAL COM'Y
Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation, on most favorable terms.

General Office—89 Wood Street,
PITTSBURGH, PA.

Branch Office—120 Water Street,
CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent
at Cleveland, Ohio.

851-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Mannattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

934-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agent, ALFRED PARMELE, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, } Baltimore.
Company's Office, 15 German St., }

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

. Reference to them is requested. 904-.

THE

PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 209 South Third Street, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
Pier No. 1 (Lower Side), South Amboy, N. J.

866-1y

CANNELTON COAL COMPANY

Miners of the celebrated CANNELTON CANNEL, acknowledged to be the *best enricher* produced in this country, yielding 10,000 cubic feet of 64.54 candle gas per ton of 2,240 pounds.

J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.

SALES AGENTS: PERKINS & CO., New York. BENEDICT & DOWNS, New Haven.
DANIEL W. JOB & CO., Boston. DAVIS, MAYER & CO., Baltimore.

FORT PITT GAS COAL

THE FORT PITT COAL CO.

OFFER THEIR CELEBRATED

Fort Pitt Gas Coal,

Carefully Screened and Prepared for Gas Purposes, Delivered at any Point reached by Railroad or Navigation, on the Most Favorable Terms.

Office, No. 337 Liberty Street,

PITTSBURGH, PENN.

Box 314. J. E. McCRICKART, Manager.

THE MONTAUK GAS COAL COMPANY

JOHN WHITE, President,

Smith Building, 3, 5, & 7 Cortlandt St., N. Y.

WHARVES, LOCUST POINT, BALTIMORE, MD.

JAMES BOYCE, Agent and Shipper, BALTIMORE.

English and Provincial Gas Coals,

THE BEST QUALITIES OF PROVINCIAL COAL FROM THE MINES AT

SYDNEY, GLACE BAY, AND LOUISBURG, C. B.

ALSO

Abram Co.'s Arley Gas Coal and Cannel, Higginson's North Ince Hall Gas Cannel, Townley & New Pelton Newcastle Coal.

DELIVERED AT ANY PORT IN THE UNITED STATES

21 Exchange Place, Boston. **PERKINS & CO.,** 45 South Street, New York.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S, A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem.

Signed—A. T. GOSHORN, Director General

J. R. HAWLEY, President.

GROUP JUDGES.

AMERICAN.

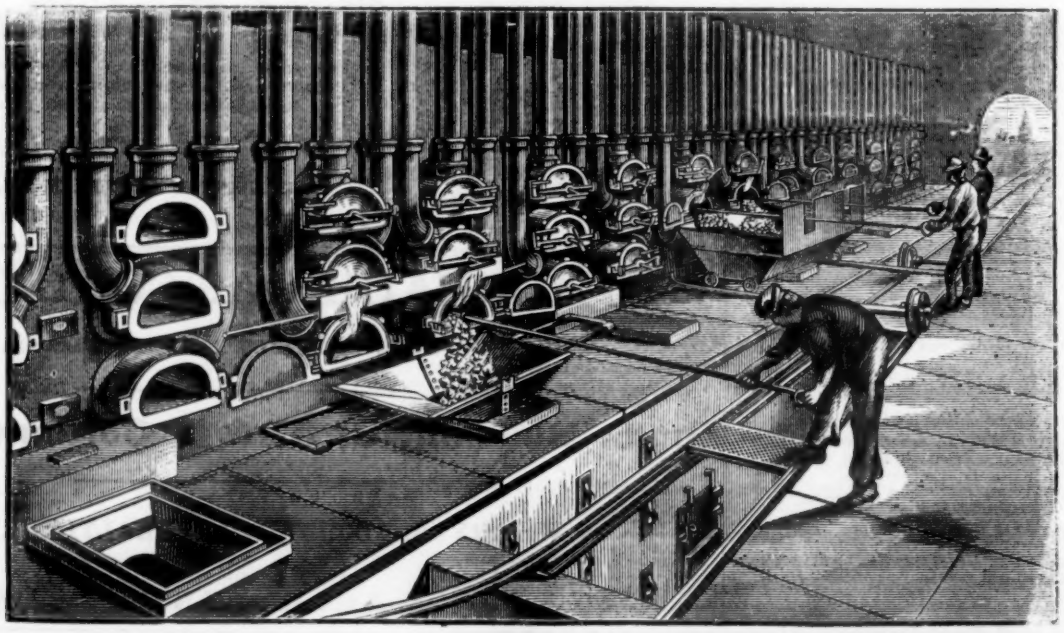
PROF. JOSEPH HENRY, LL.D., Secretary of Smithsonian Institution, Washington, D. C.
PROF. F. A. P. BARNARD, S.T.D., LL.D., President of Columbia College, N. Y.
PROF. J. E. HILGARD, Washington, D. C.
PROF. J. C. WATSON, Ann Arbor, Michigan.
GENERAL HENRY K. OLIVER, Salem, Massachusetts.
GEORGE F. BRISTOW, New York.

FOREIGN.

SIR WILLIAM THOMSON, LL.D., D.C.L., F.R.S., Great Britain
JUL. SCHIEDMAYER, Germany
MR. E. LEVASSEUR, France.
P. F. KUPKA, Austria.
EDW. FAVRE PERRET, Switzerland.

Chas. F. Dieterich's Regenerator Furnace.

CAN BE ADAPTED TO ANY BENCH WITHOUT DISTURBING THE ORDINARY SETTINGS.



These Furnaces have been in operation at the works of the People's Gas Company, Baltimore, since June, 1878. A bench of 6's, with retorts 20in.x12in.x8ft. 6in., will burn off 1,350 pounds of coal in 3 hours. Twenty-five per cent. of the coke is sufficient to thoroughly burn off the charges.

State, city, and factory rights granted on reasonable terms. For full particulars apply to either

CHAS. F. DIETERICH, Eng'r People's Gas Co., BALTIMORE, MD.

WM. FARMER, 111 Broadway, N. Y., F. L. HAGADORN, 162 Beach St. Chicago, Ill., or HENRY J. DAVISON, 231 Broadway, N. Y.

T. C. HOPPER, Prest. and Gen. Supt. WM. H. HOPPER, Vice-Prest. WM. N. MILSTED, Treas. WM. H. DOWN, Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES—AMERICAN, FRENCH, & ENGLISH.
SUGG'S ILLUMINATING POWER METER.
SUGG'S "STANDARD" ARGAND BURNERS. ALSO NN AND TTT.
Wet Meters, with Lizar's "Invariable Measuring" Drum.
Sole Agents for Wm. Cowan's Automatic Pressure Changer.

Agencies:
37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco.

HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 33 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WILLIAM HELME. JOHN McILHENNY.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. H. DUMONT WAGNER, Supt. S. L. JONES, Sec. S. V. MERRICK, Asst. Sec.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street, Philadelphia, Pa.

No, 142 Chambers Street, New York

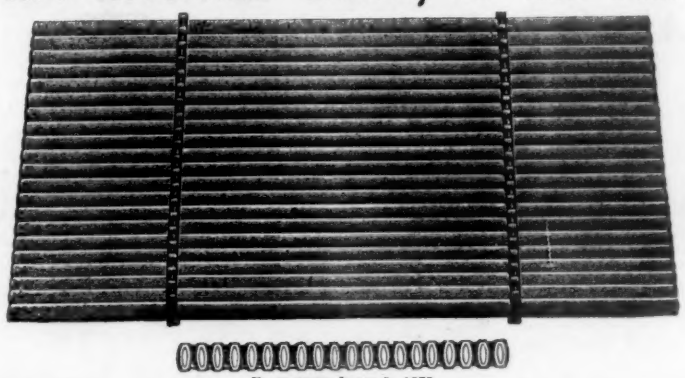
MANUFACTURERS OF GAS STOVES FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

Church's Reversible Screen, for Gas Purifiers.



PATENTED JULY 9, 1878.

Reversible, Very Durable, & Easily Repaired. Oval Slats, with Malleable Iron Cross Bars.

Apply to CONTINENTAL WORKS, Greenpoint, N. Y., or DAVIS & FARNUM MANUFACTURING CO., Waltham, Mass., who are authorized to build them, or to

GEORGE D. CABOT, Agent Lawrence Gas Co., Lawrence, Mass.

REFERENCES:—Lawrence Gas Co., Lawrence Mass.; Roxbury Gas Co., Roxbury, Mass.; Newport Gas Co., Newport, R. I.

NOW READY AND FOR SALE,

FODELL'S
System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Order or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL Philadelphia, or

A. M. CALLENDER & CO
OFFICE GAS LIGHT JOURNAL, 42 Pine St., N. Y

CATHEL'S
GAS CONSUMERS MANUAL.

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

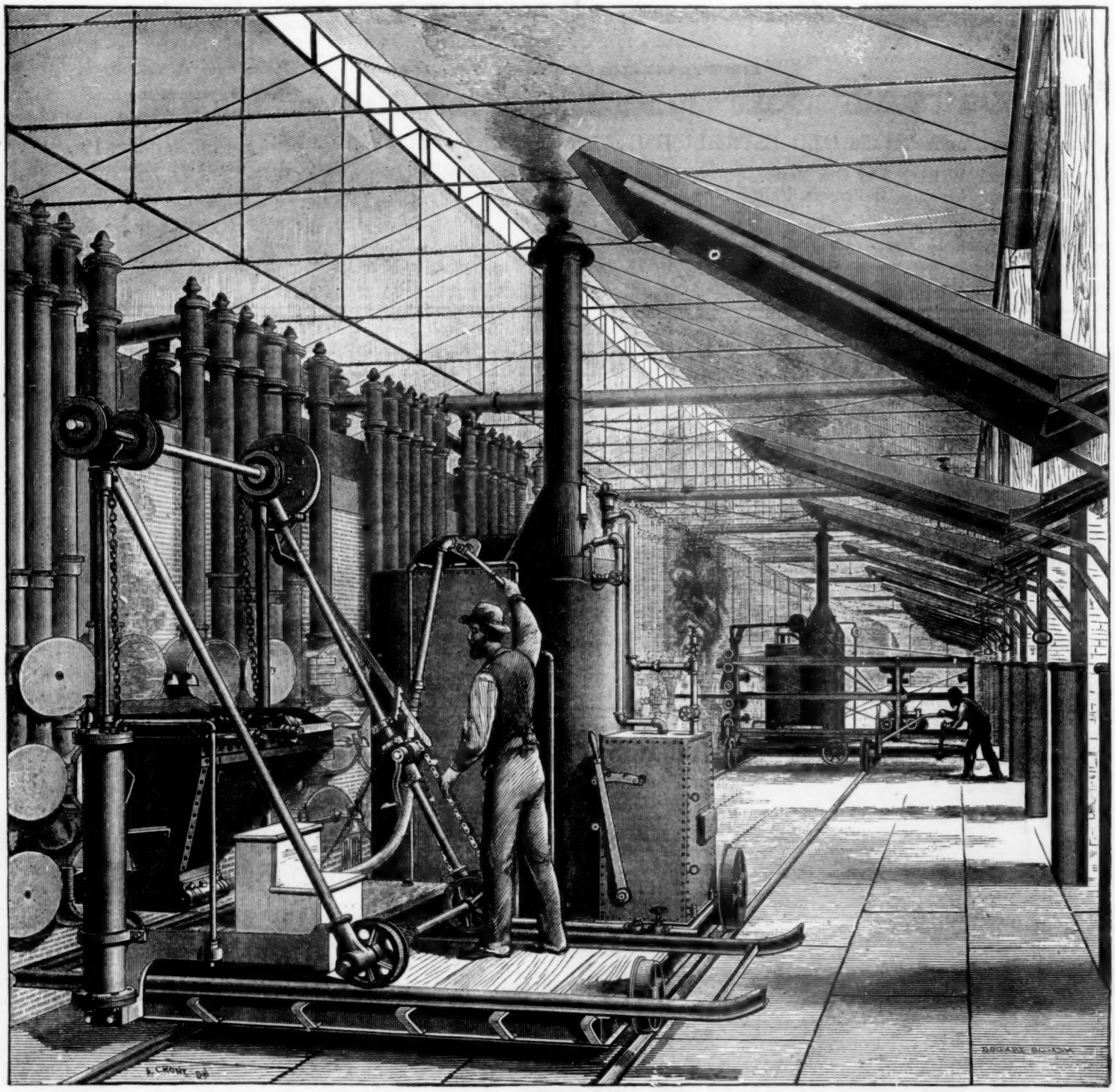
It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaint arising from their want of knowledge in regard to the registration of the meters. For sale by

A. M. CALLENDER & CO
43 Pine Street, New York Room 1

A. Q. ROSS'

STEAM STOKERS.

Now in continuous and systematic operation at the works of the Cincinnati Gas Light and Coke Company, Cincinnati, Ohio, where for the past sixteen months they have been drawing and charging retorts at the rate of one every minute. Simple in construction, and easily operated by any intelligent man.



Address, A. Q. ROSS, Manager,

U. S. STEAM STOKING COMPANY, CINCINNATI, OHIO, U. S. A.